MARICOPA ASSOCIATION of GOVERNMENTS

MAG EMPLOYMENT DATABASE

FINAL REPORT

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1.0 INTRODUCTION

This report describes the work performed by Applied Economics and it's subcontractors for the Maricopa Association of Governments' (MAG) Employment Database Project. This project was initiated in the spring of 1995, although the majority of the work was performed over a 10-month period from September 1995 through June 1996. Compilation and verification of employer data was primarily done during the winter of 1995-96. This timing was selected to reflect the employment situation at the time of the Special Census of population conducted in October 1995, as closely as possible. Work performed since that time has consisted primarily of refining the database, and producing small-area employment estimates.

The sections of this report that follow describe the work performed for each task included in the final scope of work for the project. These descriptions generally include the goals of each task, the processes utilized in achieving those goals, and the subsequent results. MAG staff and member agencies were kept informed of progress throughout this project and provided with reviews of the data and estimates as they were produced.

The tasks in the final scope of work included:

Task 1: Refine the Scope of Work

This project was of sufficient size and complexity that it was necessary to finalize certain elements of the work scope during the project. Task 1 resulted in the final scope of work briefly outlined below.

Task 2: Document Existing Information

Existing methodologies for performing small-area employment estimates were researched and documented. This task included research into the availability and suitability of employer data from public and private sources, as well as the methodologies used by other regional transportation planning agencies to perform small-area employment estimates. The results of this research are documented in Chapter 2, Background Research.

Task 3: Develop Methodologies

This task consisted of two main parts: developing a methodology for assembling and verifying employer data; and developing a methodology for producing small-area employment estimates. These processes are described in Chapter 3, Methodology.

Task 4: Assemble Employer Data

Task 4 consisted of compiling and analyzing the employer site data to serve as the base set of data for this project. This work is described in Chapter 4, Employer Database Development.

Task 5: Database Development

Development of the Employer Database included examination of employer site records for errors and omissions, verification of employment and address information for sites with more than 50 employees, and geo-coding of all records in the database. This development process utilized a multi-faceted approach which is also described in Chapter 4, Employer Database Development.

Task 6: Employment Estimates

Working with the Employer Database and utilizing a Maricopa County control total, Applied Economics produced estimates of 1995 employment by MAG land use sector by Traffic Analysis Zone (TAZ). The methodology developed to utilize employer site data in the small-area estimation of employment is described in Chapter 3. The results are presented in Chapter 5, Employment Estimates.

Tasks 7 and 8: Prepare Deliverables and Final Documentation

These tasks include the overall documentation and summary of this project, and the delivery of the databases created in digital format. The database includes the data tables, and forms, queries, and reports used during this project. Associated project materials, such as other data files or analytical tools, shall also be transmitted to MAG.

While every effort has been made to provide the most accurate and complete information possible, MAG, Applied Economics, and its subcontractors make no guarantee, expressed or implied, as to its accuracy and expressly disclaim all liability for the accuracy thereof. This work is part of a process necessary to support a sophisticated socioeconomic modeling program like MAG's, and by its nature will continue to need updating and refinement.

2.0 BACKGROUND RESEARCH

This section describes the work performed in evaluating the availability, comprehensiveness, and accuracy of employer information and employment estimate methodologies. Specifically, the background research focused on identifying which source, or sources, of information would best serve as the base upon which to build a comprehensive employer/employment database for use by the Maricopa Association of Governments.

Following is a brief description of the results from interviews with other regional planning agencies; data sources identified and their suitability for use on this project; and a review of the methodology utilized in compiling an employer database for MAG by Economic Strategies Group in 1993.

2.1 INTERVIEWS WITH REGIONAL AGENCIES

Telephone interviews with representatives from six selected Councils of Government (COG) revealed some commonalities in the approach to producing small area employment estimates, but no unanimous approach. Figure 1 summarizes the interviews in a matrix of COG responses to five areas of discussion. The COG's contacted included:

- Dallas (NCTCOG)
- Denver (DRCOG)
- Los Angeles (SCAG)
- Minneapolis-St Paul (Metropolitan Council)
- San Diego (SANDAG)
- Seattle (PSRC)

The Minneapolis-St Paul organization does not maintain its own small area estimates, but contracts for data with the state Department of Economic Security. The remainder of this section applies to those COG's that do maintain employment estimates.

In general, the basis for small-area employment estimates is an employer database of some type that has been geocoded. No contacted COG produces such estimates on an annual basis, or has more than five years between update cycles.

The common approach to building/maintaining an employer database is to purchase a set of records (all records for a region without an employment level restriction) from Dun and Bradstreet that is then combined with some other data source. The resulting master file is then searched for duplicate records and data discrepancies which are handled through phone survey or checked against more localized and/or specialized sources of data. Only the Seattle COG performs employment estimates without maintaining its own employer database. They rely solely on ES202 data, which they geo-code, but which is aggregated by their state DES.

While using land use data as a part of the estimating process has been a topic of discussion in Denver, only Dallas (NCTCG) is utilizing a land use to employment matrix. NCTCG also performs employment calculations based on the square footage of commercial buildings.

FIGURE 1

INTERVIEWS WITH REGIONAL PLANNING AGENCIES

QUESTION	SAN DIEGO (SANDAG)	METROPOLITAN COUNCIL Minneapolis/St. Paul	NORTH CENTRAL TEXAS COUNCIL OF GOVTS (NCTGOG)
Does your organization maintain small-area employment estimates? Done in-house or provided? What geography? How often?	Yes, every 2 years previously, going to 5 years between estimates. Sites are geo-coded, aggregated to other geographies as needed.	No, estimates are done by Dept. of Economic Security by contract.	Yes, TAZ level, every 5 years.
What is the basis for the estimate? (i.e. employment data (aggregated to some geography), Census Transportation Planning Data, employer database, land use data, parcel data (Assessor), other? (specify if combination)	Employer database, and California Employment Development Department		Major employer database (400+ employees per site); commercial structures file; land use to employment matrix; State Controller's Office and Economic Commission for control figures.
What is the source of the base information? How often is it updated? Do they get and use it?	Dun & Bradstreet and American Business Information files, with records for all (any size) county establishments.		Dun & Bradstreet; previous major employer data; Business Marketing Services (local source); ES202 (marginally).
Briefly describe your methodology for employment estimates. For updates?	Use the state (EDD) annual average employment for the County, which is produced by 1-digit SIC, as the control figure. Employment figures from the Employer Database for the SICs are summed, then factored (by SIC) by the percentage difference to equal the County employment total.		Start with control figure; subtract major employers; subtract commercial structures derived employment and land use employment. Residual employment allocated to land use, and commercial structure if necessary. Results are reviewed by municipal planners, then re-adjusted.
If employer data is used/maintained, how do they compile and verify it, i.e., duplicates, name/address changes, employment/SIC data accuracy? How do they handle off-site employment? Part-time employment?	D&B and ABI data are combined; estimated 2-3 person months are used to search for duplicates, and revise data using various sources, such as local directories, government commuter files, and chambers of commerce.		Employer data files are combined, searched for duplicates and problems, resolved through telephone verification.

FIGURE 1 (Continued)

INTERVIEWS WITH REGIONAL PLANNING AGENCIES

QUESTION	DENVER REGIONAL COUNCIL OF GOVTS (DRCOG)	SOUTHERN CALIFORNIA ASSOC OF GOVTS (SCAG)	PUGET SOUND REGIONAL COUNCIL (PSRC)
Does your organization maintain small-area employment estimates? Done in-house or provided? What geography? How often?	Yes, TAZ level, every 3 years.	Yes, by Census Tract every 2 years.	Yes, primarily by Census Tract, every 2 years.
What is the basis for the estimate? (I.e. employment data (aggregated to some geography), Census Transportation Planning Data, employer database, land use data, parcel data (Assessor), other? (specify if combination)	Employer database, and Bureau of Labor Statistics Data.	Employer database	Employment data, geo-coded
What is the source of the base information? How often is it updated? Do they get and use it?	Dun & Bradstreet, all records for the region; ES202 for establishments with over 100 employees (by non-disclosure agreement with the state).	Dun & Bradstreet (file with all records), American Business Information (file with all records), County Business Patterns, Reg 15 Ride Share Program, Employment Development Dept for control figures.	ES202, used with the Dept of Economic Security.
Briefly describe your methodology for employment estimates. For updates?	Use BLS employment for the counties are the control total. Employment figures from the Employer Database by SIC are summed, then factored (by SIC) by the percentage difference to equal the counties employment figures.	Employer Database is summed and checked against County Business Patterns and California EDD. Employment is factored to the control figure with a weighted allocation based on 4-digit SIC. Assumption is that employment would cluster geographically.)	DES provides list of addresses, PSRC geocodes and returns to DES which then provides employment figures from ES202 by SIC and the geography level. BLS factors based on national data estimating the proportion of uncovered to covered employment are used to increase employment from the ES202 data, i.e., covered (ES202) employment * percent uncovered. There is no control figure. Employment not geo-coded allocated to areas with like employment. Franchise operation employment assigned to number of addresses provided by ES202, e.g., if only one address for multiple convenience stores, all employment assigned to that one address.
If employer data is used/maintained, how do they compile and verify it, i.e., duplicates, name/address changes, employment/SIC data accuracy? How do they handle off-site employment? Part-time employment?	D&B and ES202 records are combined, then searched for duplicates or inaccuracies. Off-site employment is counted at the office location. Part-time employment would be adjusted for when areas are factored to BLS control.	Base data is combined, saved as a backup file. Statistical software searches combinations of fields to located duplicates. Off-site employment is counted at office location.	Proprietary employer data, such as D&B has been considered but not used.

County-level employment figures are used as a control total (except in Seattle), and employment from the employer database is factored by a percentage to equal the established control figure. Usually, these adjustment factors are calculated and applied at the 1-digit SIC level of detail. Estimates for the Los Angeles (SCAG) region vary slightly in that they utilize a statistical software package to perform a weighted allocation of residual employment based on 4-digit SIC codes, with the assumption of a "clustering" effect, i.e. employment would not be evenly distributed but would tend to cluster with other employment of the same type.

The cost of producing employment estimates seems to be a significant factor in the method used. This provides some reason for the disparity of methods, from the least extensive method utilized by PSRC to the more complex and time-consuming procedures used by the NCTCOG

While all persons interviewed felt there were limitations in accuracy of the data, both in the employer data and the control data, it was commonly felt that current methods were as reliable as could be achieved at the present time, though additional methods were sought.

2.2 EMPLOYER DATA

Information on local employment activity is often collected and compiled by both public and private sector organizations from a variety of sources. However, no single "master list" exists, and it is known that there are limitations with both government and commercial employer files. The object of this task was to identify the public and private sources from which a master list could be compiled for MAG's use.

Following are summarized reviews of the data sources considered for use in this project:

Dun & Bradstreet. Probably the best known of the commercial suppliers of employer data, Dun and Bradstreet has historically collected information on businesses as a part of its role as a credit rating agency, though it has broadened its scope in the last several years. Unlike most other commercial vendors, Dun and Bradstreet uses specific figures for their employment data, rather than providing only a range, such as 20-49 employees. It is currently being used as a basis for the employer databases for all four of the COGs we surveyed who maintain their own such databases.

Weaknesses with Dun and Bradstreet, or any commercially produced employment data file, stem from the fact that businesses are not required by law to list with such sources. Also, business data is self-reported and not subject to regulatory scrutiny. Since most businesses listing with Dun and Bradstreet do so for credit rating purposes there may be some motivation to inflate employment data. Dun and Bradstreet also has difficulty capturing sole or family proprietorships and new start-ups, particularly when such businesses begin operations with noncommercial credit. Commercial sources of data are also more likely to contain out-of-date information, both due to the magnitude of the files and the fact that businesses that close or fail have no incentive to report such changes to private sector companies.

Strengths with Dun and Bradstreet lay primarily with the fact that they are the largest supplier of such data, and report more specific data. The data supplied is well-regarded, comparatively speaking, and is used by several state and local government entities.

Inside Contacts. As another commercial vendor of data, Inside Contacts has the same drawbacks in data comprehensiveness and accuracy as Dun and Bradstreet. As the name of the company implies, the focus of their research is the name of primary contact persons at companies, not employment data. This being the case, employment data by Inside Contacts is provided in ranges, such as 20-49 employees. Since approximately 5,000 establishments in Maricopa County are estimated to fall into that particular range, such data reporting carries with it some obvious problems with accuracy.

LeadSource. This Tempe company produces employment data which is updated quarterly and appears to contain a nearly comprehensive universe of business establishments in Maricopa County. Besides the common drawbacks for commercial vendors of employment data, LeadSource provides employment data in ranges, and employment data and SIC codes are not present in a significant portion, approximately 30 percent of the records.

Strategic Mapping. This vendor, like Inside Contacts, also serves as a broker for Dun and Bradstreet data. The company also sells Atlas GIS software, and records obtained from them are geocoded, with a reasonable degree of accuracy. This company shares the same limitations previously mentioned regarding commercial vendors and secondary data brokers.

US West. The regional telephone company also maintains a database with employment listings. As would be expected, their universe of business establishments in Maricopa County, 59,800, appears very comprehensive. However, US West uses secondary sources for additional establishment data, primarily credit companies including Dun and Bradstreet. Of the total records on file for Maricopa County, the US West database only contains both SIC and employment data for 60 percent. An additional drawback is that employment data is given in ranges, rather than specific figures.

Harris Publishing Company. Founded in Ohio in the early 1940's, this company publishes full Harris Directories for 15 Midwestern and Southern states and a national manufacturing directory. Harris has a good reputation for accuracy in reporting, but at this time does not do a full directory for Arizona. The national directory includes only manufacturing firms with greater than 100 employees; all such companies will be surveyed during this project. At this time, Harris Publishing Company products are of very limited use for the scope and purpose of this project.

American Business Information. Beginning with telephone directories and following up with other data sources, ABI then performs extensive telephone verification of data. While a very comprehensive source, ABI also lists employment only in ranges.

Department of Economic Security - ES202 File. State employment security agencies collect employment and payroll information from individual business establishments under the Covered Employment and Wages program. Known as the ES202 establishment file, it is compiled by the Bureau of Labor Statistics (BLS). This file is an administrative database developed as a means for tracking compliance with unemployment insurance legislation and not for measuring economic activity. As such it contains some limitations, such as identifying establishment start-ups and, to a lesser extent, closings. As is the case with commercial data sources, the limitations are most prevalent in rapidly changing service and retail sectors, and with sole or family proprietorships.

While data from the ES202 file is becoming more available for sub-county economic research in some places, the use and access in Arizona is still very limited. One of the obstacles to using ES202 data for sub-county estimates in Arizona is that employers are not required to report employment by site, only by county. However, the BEL (Business Establishment List) project underway by DES is attempting to solicit site information from businesses with eight or more employees at additional sites. Participation in the program is voluntary, and so far only about 16% of the State's businesses are reporting site-level information.

If a legislative change could be made to mandate site-level reporting, then the ES202 information could potentially be used as a source for small area employment estimates. DES stated that, with improved coverage, it may be possible to create an address file of businesses to be geocoded by MAG, then aggregate the business data using those geocodes. Confidentiality issues will continue to prevent the release of site data directly to MAG or anyone else.

Maricopa County Trip Reduction. As part of a pollution reduction program, the county maintains a database of most employer sites of 50 or more employees. However, there is a small difference in the way employment is defined. They only include employees traveling to the site three or more times per week, for at least six months per year. This would result in a slight under-counting of total employment by site.

Maricopa Trip Reduction utilizes Dun and Bradstreet data as the primary beginning source and is updated at least annually. One limitation is that this database does not appear to be as comprehensive as expected from BLS establishment data for that employment range. Positive factors include the fact that the list could be obtained at no charge, and includes government employment sites and school data, which are areas commonly noted as deficiencies in commercially produced employment data files.

2.3 Review Previous MAG Methodology

In 1993, Economic Strategies Group compiled a database of major employers as a part of the Socioeconomic Models Enhancement project for MAG. While the scope and purpose of that task differed from the scope of the current project, there are similarities. It is worthwhile to briefly review the methodology utilized in the compilation of the previous database.

Major employers were defined as those employers, in the public or private sector, with 50 or more employees at a site. Restaurant and convenience store franchises were not included due to issues concerning site-specific information.

Initial data collection efforts involved acquiring six database files from MAG and one file from Claritas National Planning Data Company. The databases acquired from MAG included portions of the Maricopa County Trip Reduction database.

These data files were combined to form a single database of 4,717 employer site records. Multiple sorts on company name, address, and telephone fields were performed to identify and mark duplicate records for deletion. Actual deletions were not executed until a determination was made regarding which records had the more accurate and/or recent information.

Information obtained from Claritas provided an estimated range of the number of employees at each employment site listed but provided no specific number of employees. For the approximately 1,400 employers where other verification sources were unavailable, telephone contacts were made to obtain specific employment information and to verify addresses. These calls were performed over a three week period, with some follow-up calls for clarification when discrepancies were identified during database searches.

For chain-store operations, such as grocery stores, site information was obtained through U.S. West telephone directories. Employment information for such operations was obtained through a representative sampling of individual sites from the operations' various metropolitan Phoenix locations. The resulting averages were applied to the remaining facilities.

Other sources utilized to verify information or to add additional sites included:

- Arizona Industrial Directory
- Arizona Department of Education
- Arizona Department of Commerce
- The Business Journal, Book of Lists

Throughout the data collection and verification process, local newspapers and business periodicals were referenced for facility openings, closings, or changes in employment.

Draft information was delivered to MAG, who in turn provided member agencies with the site employment information pertaining to their cities. The MAG member agencies reviewed the information and compared it to their own sources. Recommendations for changes, additions, and deletions were received and incorporated into the database.

3.0 METHODOLOGY

This section describes the methodologies considered to prepare small-area employment estimates, and to assemble the Employer Database. In the case of the Employment Estimates, the discussion focuses on the different methodologies that were considered, and specific issues relating to the final selected methodology. In the case of the Employer Database, the methodology focuses on how data sources would be merged, and how data for individual employer sites would be verified and geo-coded.

3.1 EMPLOYMENT ESTIMATES

In the process of reviewing employment estimate methodologies under Task 2 (as described in Chapter 2), Applied Economics identified at least three distinct methods of preparing small area employment estimates. The purpose of this section is to briefly describe each methodology considered by Applied Economics, review input received from MAG staff, and present the final recommended employment estimate methodology.

The task of estimating current employment is very difficult for a number of reasons. First, unlike population and housing, there is no single government source of employer information compiled in a primary data collection effort like the Census of the Population. There is a Census of Business, but the focus is on industry breakdowns, and other characteristics of businesses, not on exact locations and number of employees within a specific geographic area. This leads to the need to rely on data from private vendors, or adapt employment information from other government sources compiled for different purposes.

Second, businesses change names, locations, employees and telephone numbers with incredible frequency. This makes the job of identifying "new" employers, and a specific number of employees very difficult. When a potential new businesses is identified from a source such as telephone connections, bank account openings, applications for credit, etc., it is difficult to distinguish new businesses from changes in existing ones. Also, since employment data is self-reported, it can contain substantial error even when sound survey methods are applied.

Finally, "employment" estimates are complicated by many definitions of employment. "Total" employment often does not include military employment. It most cases it does, however, include sole proprietors and businesses owners, who are not included in the "Wage and Salary" employment figures most often published. Also, one person may hold more than one job, thus creating a difference between the number of people employed, and total employment as it is most commonly reported.

Small-area employment methods must first identify the universe of employment to be estimated. With this established, the next step is to aggregate point level information from employer establishments, or allocate county-level employment by some other factor down to small areas, or some combination of both. Ultimately, some of both would be required to prepare the employment estimates desired by MAG.

ALTERNATE ESTIMATE METHODS

Each of the three alternative employment estimate methodologies considered by Applied Economics were variations on approaches developed in Maricopa County and elsewhere. The goal of each methodology was to estimate total, civilian employment by Traffic Analysis Zone for Maricopa County.

Each of the methodologies considered were the same in that:

- They use industry (SIC) based control totals, which could be adjusted to account for the work-at-home population;
- They rely heavily on the use of geocoded employer information by SIC; and
- They must address the conversion of employment by industry, to employment by land use at some point in the process.

However, the methodologies also differ in many ways. The most fundamental difference is in the basis used to allocate that portion of employment not accounted for by the Employer Database. Most of the COGs surveyed in Task 2 use only employer data to perform their small-area estimates. Only the North Central Texas Council of Governments uses a methodology similar to MAG's past approach, utilizing land use and development data to supplement employer data.

From this research, and based on our previous experience, we found three possible approaches to performing small-area employment estimates for MAG:

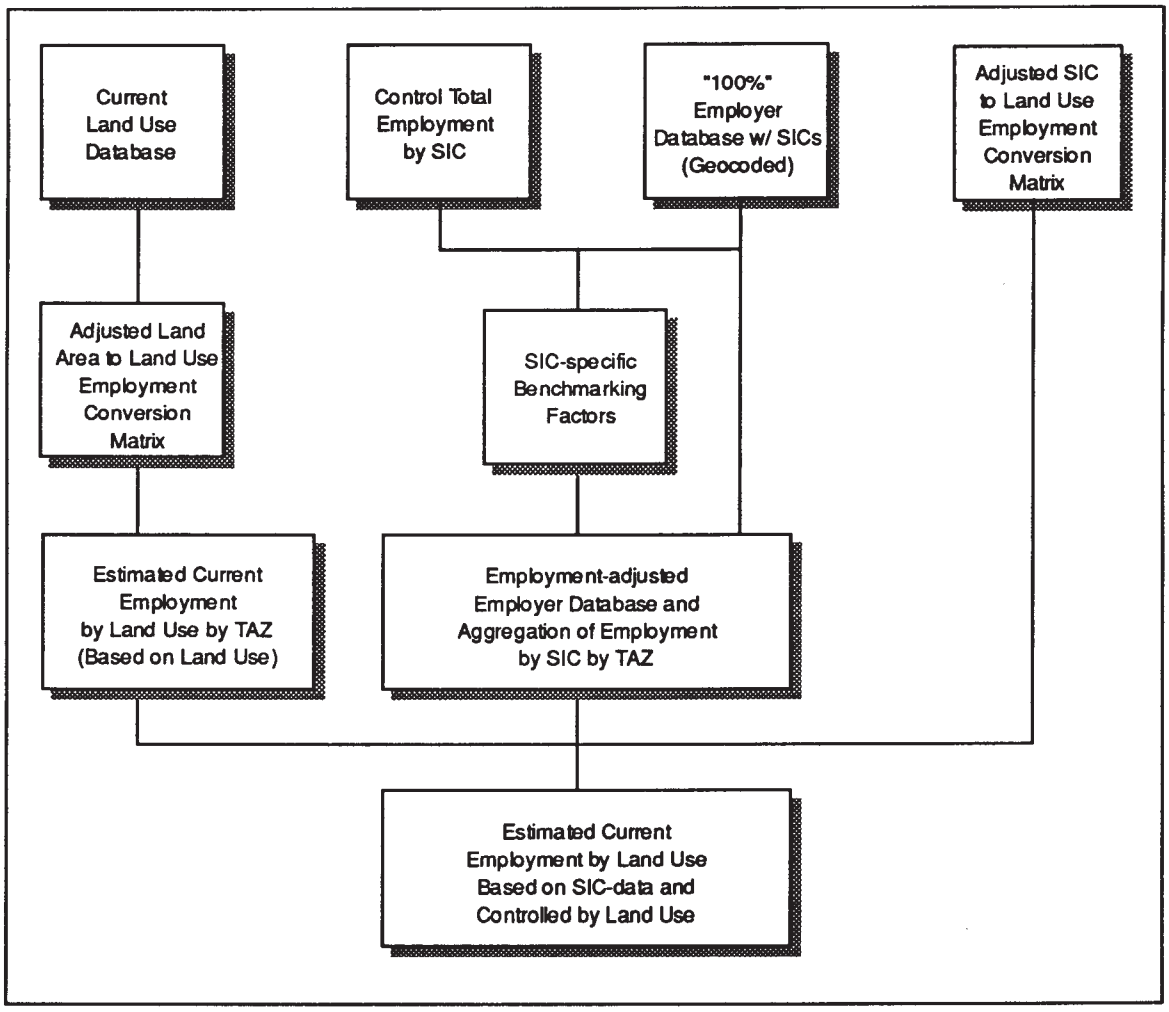
Alternative 1: Employer Data & Benchmarking by Industry

As shown in Figure 2, this methodology uses an expanded employer database to include as many businesses as possible. The goal in this method is to capture as close to 100 percent of all employment possible through the Employer Database. Total employment by industry is calculated by summing the employer records. These industry totals are then compared to the control total by industry, calculating a "benching factor" by industry. This factor is then applied to all employer records in that industry group, which are then aggregated to any desired level of geography.

Four of the six COGs surveyed in Task 2 use this approach, or one very similar to it. The final product for most COGs is small area employment by industry, not land use as desired by MAG. Therefore, in the case of MAG, it would be necessary extend this methodology to translate employment by industry to employment by land use. This step would be performed by using a combination of MAG's standard industry to land use relationships, and the known current land use in each geographic area (TAZ).

The chief advantage to this methodology is simplicity. A single source of employer information, usually Dun & Bradstreet, is used to form the basis of the estimate. Benchmarking employer data using industry control totals insures that the integrity of the industrial structure is preserved. The conversion of industry to land use would only be made at the end of the process, and could be controlled using existing land use information.

FIGURE 2
"100 PERCENT" EMPLOYER DATABASE APPROACH



On the downside, this type of benchmarking will only allocate employment to places where employers are known to exist. It will likely miss some employment in the fringe areas, where only very small employers are likely to exist. Furthermore, this method would almost triple the size of the employer database from the proposal (to about 88,000 records), thus tripling the required data budget.

Alternative 2: Land Use/Employer Database Method #1

This methodology, which is diagramed in Figure 3, is very similar to the methodology used by MAG in the past for employment estimates. It begins with the conversion of control total employment by SIC from the Arizona Department of Economic Security, to employment by land use using an industry to land use matrix. Next, land use databases by TAZ are converted into employment potential using a set of employment density measures.

Employment from the Employer Database aggregated to TAZs is then converted into employment by land use, and subtracted from the potential employment by TAZ. Total employer-based employment by land use is then subtracted from the employment control totals to yield residuals. This residual employment is then allocated to TAZs with a balance of employment potential.

The advantage of this method is that it can be implemented using a partial employer database (as specified in the proposal scope of work), and that final employment by TAZ is consistent with the land use data files. The disadvantages of this approach are the variations that exist in the correlation between land use and industry for small areas. Since this method would require that this conversion be performed for the entire Employer Database, up to 80 percent of total employment could be at risk using this conversion.

Alternative 3: Land Use/Employer Database Method #2

A variation on Alternative 2, this method uses the same basic approach except that employment by SIC from the Employer Database is analyzed and allocated to all TAZs, before the residual employment potential is calculated (See Figure 4). The employment from the Employer Database is also aggregated by SIC and subtracted from the County control totals (by SIC), and only the residual would be allocated to TAZs by virtue of the industry to land use conversion matrix.

This methodology shares all the same advantages as Alternative 2, above. Furthermore, depending on the level of variation in the correlation between employment by land use and employment by industry in each small geographic area, the results could be somewhat more accurate. In other words, the more a particular geography is less like the County as a whole, the more likely it would be that this methodology would yield better small-area employment estimates.

This methodology also shares the same disadvantages as Alternative 2. However, since the share of the estimate that is solely dependent on industry to land use, and land use to employment correlation matrices would be smaller, the results may be somewhat better.

FIGURE 3
LAND USE / EMPLOYER DATABASE METHOD #1

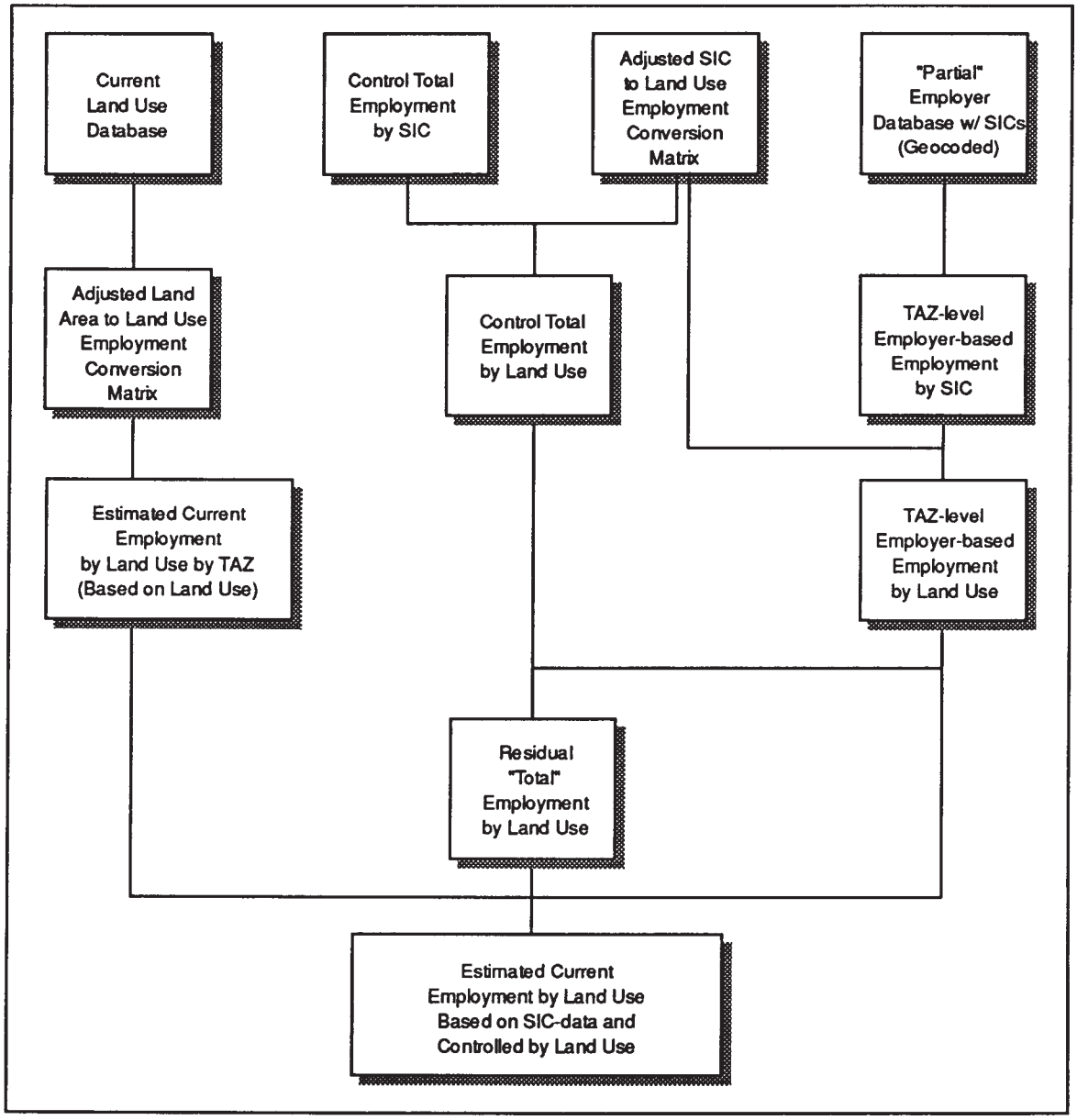
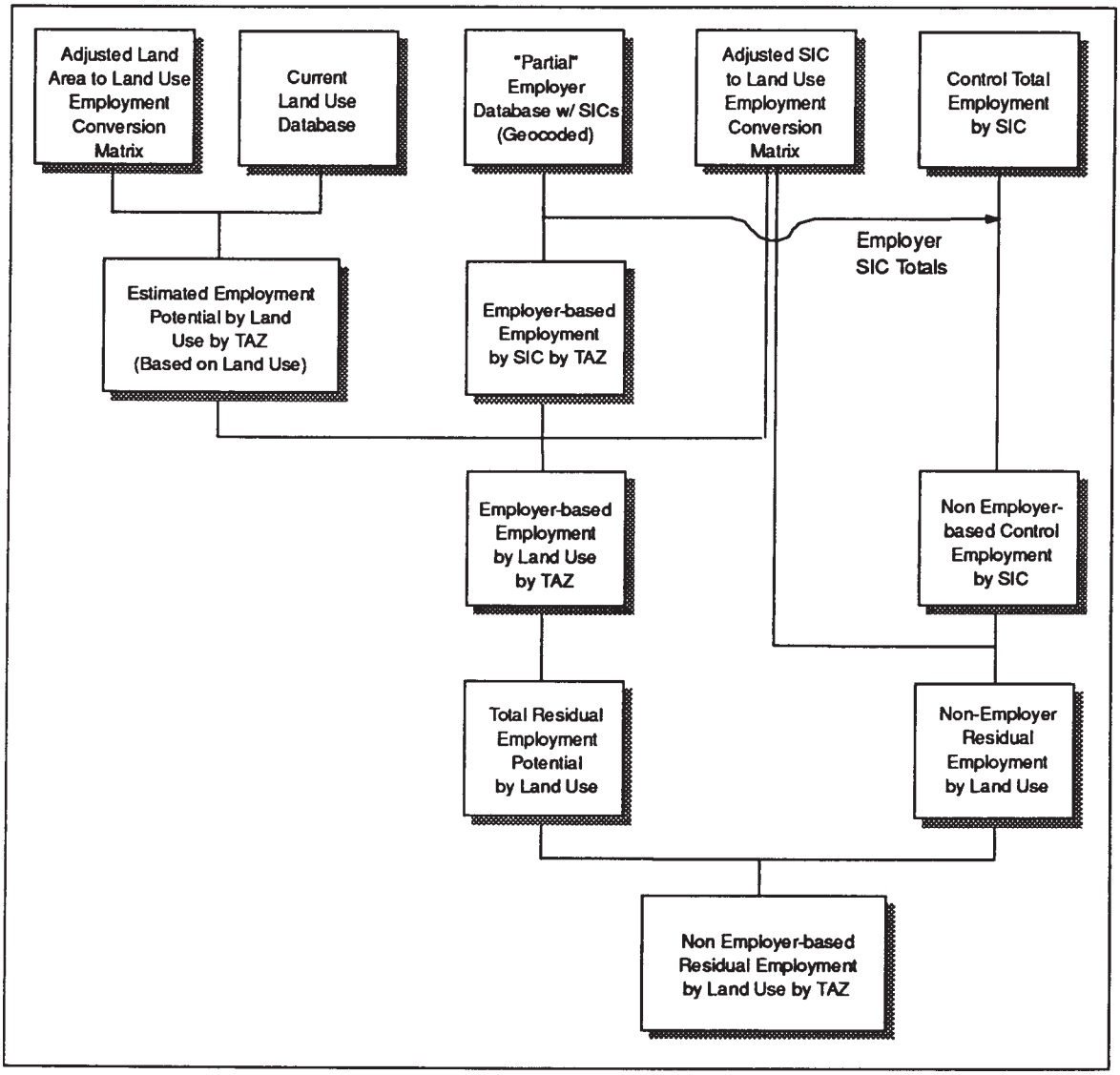


FIGURE 4
LAND USE / EMPLOYER DATABASE METHOD #2



RECOMMENDED METHODOLOGY

Based on a review of the three alternative methodologies presented above, MAG staff elected to further investigate the possibility of basing the 1995 employment estimates on a "100 percent" employer database (Alternative 1). Simplicity, the ability to update using a clear methodology, and the ability to aggregate the employment estimates to any geography were all factors contributing to MAG staff's decision.

In addition, it was recommended by MAG staff that the process of assigning employment to land use categories should be done by overlaying the geo-coded employer sites onto MAG's land use coverage. This technique would by-pass the need to model the conversion of employment by industry to employment by land use. Unfortunately, it was not possible to prepare a digital street file for geo-coding that would overlay properly on the digital land use data in the time available. As a result, it was necessary to modify the final methodology to use land use information at the TAZ level, combined with the industry to land use matrix, to assign land use to each employer location.

The final recommended methodology, shown in Figure 5, contains five major tasks:

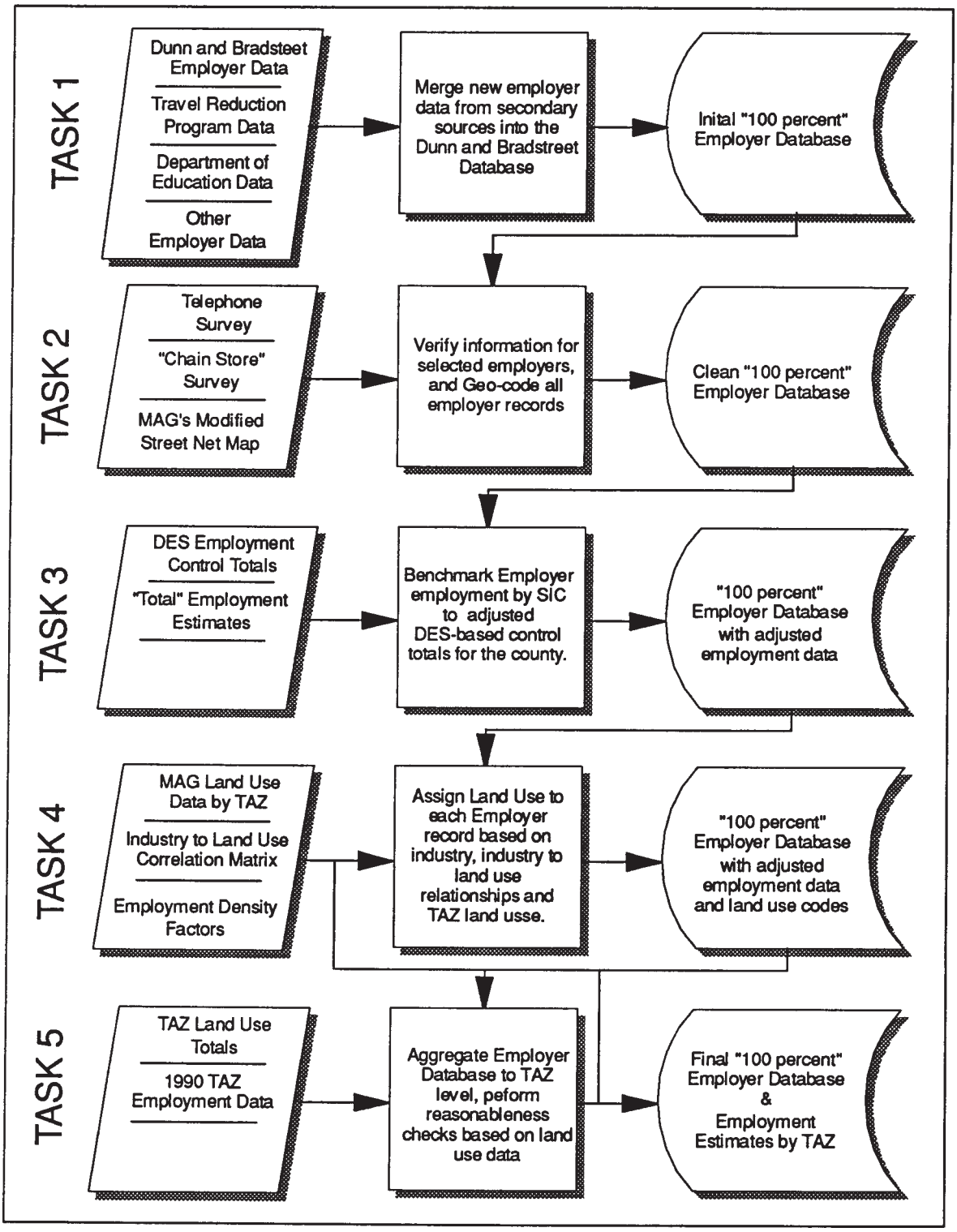
Task 1 - Assemble Employer Database.

Task 2 - Verify and Geo-code Employer Database businesses. Unlike the methodology described under Alternative 1 (shown in Figure 2), the employer data purchased from Dun & Bradstreet was not geo-coded (did not contain initial "x & y" coordinates). Buying the employer data with geo-codes would have increased the cost of the data by about 40 percent, and the accuracy of the geo-coding would have been in question. It is not so much that D&B's geo-codes would be "wrong," but it is more likely that the geo-coding method, and geographically encoded street file, may not coincide well with MAG's other geographically-based data files.

Task 3 - Benchmark Employer-Database employment to DES SIC county totals. Employment by SIC was aggregated from the final Employer Database, and compared with DES-based employment estimates by SIC for Maricopa County. It was necessary to create DES-based estimates of total civilian employment by SIC by adjusting DES Wage and Salary employment by SIC to account for the self-employed.

Once the DES-based estimates were complete, an adjustment factor was derived for each SIC category by dividing the DES-based employment estimates by the Employer Database employment estimates. The appropriate adjustment factor was then applied to the employment in each record of the Employer Database, based on its SIC category. These adjusted Employer Database employment levels were then used for the calculation of the small area employment estimates.

FIGURE 5
RECOMMENDED METHODOLOGY



Task 4 - Assign land use to businesses. In the absence of the ability to geo-code the employment sites to directly overlay on the digital land use maps, the assignment of land use for each employment site was modeled. The model based the assignment on the industry and size of the employer, known industry to land use relationships, and the land use character of the TAZ containing the employment site. While we expected to see the same industry assigned to multiple land uses, the realm of land uses was limited to a logical, employment-bearing subset.

Once initial land use assignments were made, we ran cross-tabulations of businesses and employment by industry with land use to examine the correlation between employment and land use. Total employment in each major land use category was compared with known developed acreage by land use, and well known total square footage information from the assessor's office, to calibrate the assignment model.

Task 5 - Aggregate bench-marked employment by land use. Depending on the success of assigning land use to employers records based on geo-coding, this task could have required very little, or very significant effort. Since the land use assignments were made successfully in Task 4, the approach here was to simply aggregate employment by land use from the Employer Database records. Since the aggregation used the benchmarked employment data, the estimates were complete at this point.

However, if the task of re-assigning land uses to the Employer Records was not successful in Task 4, then it would have been necessary to model employment utilizing land use data aggregated to the TAZ level. By using employment by industry by TAZ (from the Employer Database), and the total acres by land use by TAZ, it would have been possible to model the likely distribution of employment by land use.

3.2 EMPLOYER DATABASE METHODOLOGIES

Since the final selected methodology for the employment estimates was a "100 percent" employer site database, assembly of the Employer Database became the most important part of the project. It also meant that the Employer Database would be much larger than originally anticipated, requiring greater thought as to how the data would be compiled, stored, verified and geo-coded. This section includes a description of the sub-tasks created to address each of these critical steps in the development of the Employer Database. While these sub-tasks are treated separately for the purpose of this discussion, it should be noted that they are very interrelated and may be performed recursively.

DATA SOURCES AND COMPILATION

Since there was no known single source of employer data that would have provided for the comprehensiveness desired on this project, it was necessary to compile data from multiple sources. The basic problem with this method was that many data sources utilize the same information, so compilations would result in large numbers of duplicate entries, and many of the same businesses might be missed. Also, with this approach a large amount of effort would be expended looking for duplicate entries, with no guarantee that all would be located, or that the entries retained through the process would contain the more accurate information.

In order to minimize these issues, Applied Economics recommended using just one large set of employer data, purchased from Dun & Bradstreet, as a base. Additional data sources were then compared to this base data to add only specific records, or groups of records, to the original database, with the potential for duplicates checked before the addition of records. This more focused method minimized the problem of duplicate records and allowed for greater emphasis in verification, geo-coding and other areas of work.

The initial employer data set was composed as follows:

- Dun & Bradstreet, with approximately 88,000 records;
- Maricopa County Trip Reduction, to acquire data on government employer sites, approximately 180 - 200 records; and
- Arizona Department of Education, to acquire data on schools in the county, approximately 420 records.

While duplicate records should have been a minimal problem, it was unlikely they could have been avoided altogether. The final step of the compilation process was to search for any duplicate records. This was done by utilizing multiple queries in the database software to search for duplicates based on telephone number, address, or company name.

To summarize, the basic steps of this task included:

- Purchase/acquisition of data sets.;
- Compilation by adding to the Dun & Bradstreet set records for government locations (SIC 91** to 97**) and schools (SIC 82**); and
- Search of the data for duplicate records through a series of queries, each search focusing on a different field or set of fields.

DATABASE FORMAT

While many database tables were to be used for compilation purposes, the ultimate format of the employer table was not be defined until after the initial data set had been compiled. The reason is that some field definitions were dependent on the data received. In short, lack of a fully defined structure during compilation allowed for flexibility during the initial stages of work. Once the compilation of base employer data was completed, it was possible to better define the employer site records. Also, the final record added fields for geographic data and record handling and tracking.

The final MAG Employment Database is structured as a relational database system containing two key tables: Employers and Employment. The employer table contains site specific data about employers in Maricopa County. The employment table contains TAZ specific data about employment by land use. The employment table was created by an employment estimation model, which used employer data along with other information including existing land use.

The employer/employment database also includes on-screen forms for viewing and editing records, queries for searching for records or sets of records, and reports for printing records or sets of records. The software utilized for this database is Microsoft Access, which is capable of exporting data in dBase, Paradox, Excel, Lotus, or ASCII format as necessary.

To summarize, the basic steps for this task included:

- Formatting the fields of the compiled employer table into a consistent format;
- Deleting any superfluous fields created during compilation;
- Adding fields to be used by Applied Economics and MAG;
- Importing the results from the employment estimation model; and
- Creating forms, queries, and reports as needed.

DATA VERIFICATION AND GEO-CODING

The data verification process was of critical importance for improving the accuracy of employer data, and therefore the accuracy and usefulness of the employment estimate data, which used the employer data as its primary data source. There were two areas of basic concern regarding the employer data: the number of employees, and the site address. The methodology for these two areas was addressed separately.

Employment Verification

The two common methods of verifying employment counts are to either utilize some source of data deemed more accurate, or to survey the companies directly by mail or telephone. Applied Economics utilized both methods.

During the compilation process, data about government and school employment was obtained from government sources. Data for these employers would typically be missing from commercial sources to begin with, and would be very difficult to verify by other means, including surveying. Applied Economics examined directories of data dealing with specific employment types, but could not identify any of sufficient accuracy and/or usefulness for utilization in this process.

The primary means of verifying employment for larger (greater than 50 employees), non-government sites was a telephone survey. As with other tasks of this project, Applied Economics focussed on analyzing data through the creation of specific subsets of records with common characteristics. For example, if the telephone survey call lists were sorted by SIC, and in the middle of survey of fabricated metals employers we noticed a barber shop, then the errant SIC was flagged. In this way, we were able to add additional quality control as a basic and continuing part of the process, rather than an entirely separate process.

The initial step in the phone survey was to create printed lists of company records, sorted by SIC code, city, and general employment size. The records for the largest employers were held from surveying until the surveyors gained experience with this task. Grouping records by SIC code and geographic area added some consistency in that the same surveyor worked with similar types of companies and became more attuned to unusual responses to questions, or obvious discrepancies.

The survey lists for use in the interviews were printed with the company name, address, phone number, the title for the company SIC classification, and the employment given by the original source. Upon completion of one group of records the surveyors returned each list for updating in the database and took a different list to survey. Keeping the lists small made the process more manageable.

There were two variations to the regular survey procedure:

- In the case of chain operations, such as grocery or convenience stores, surveyors called a number of individual business operations to provide for a representative sampling for each company. The remaining records in those groups were updated based upon the sample.
- In the case of very large companies with multiple location, such as Motorola, Intel, etc., an effort was made to obtain data from a single source rather than contacting each individual site.

Address Verification

The intent was for each employer site record to be geo-coded with x-y coordinates. The largest anticipated problem in performing this task was that some businesses were listed with only a post office box number, or some other type of location, rather than a street address.

For companies with over 50 employees, Applied Economics utilized the previously completed MAG employer database, and/or the Maricopa County Ride Share data to acquire actual site addresses. Also, identifying street addresses for large businesses was done during the telephone survey process. For companies with fewer than 50 employees the final approach to correcting addresses was determined based on the magnitude of the problem. Since the amount of employment was small, these records were deleted from the employer database and addressed through the bench-marking process.

Geo-coding

The geo-coding of the Employer Database records was performed in a cooperative effort by MAG staff, and team consultant Sandra Weir. The geo-coding was performed by running an address match routine using the addresses provided on the employer records, and MAG's MAGNET street file.

In implementation, geo-coding was an interactive process. All records from the employer site table were initially geo-coding using automated methods. Those records that contained problems, including mis-spelled street names or suffixes, were marked and returned to Applied Economics/Sandra Weir for resolution. Wherever possible changes to addresses were performed in batch operations, however some manual manipulation of address and the digital street file was required.

After examination and resolution of those records with geo-coding problems, the records were returned again for geo-coding. However, not all records could be geo-coded based on address. All large employers, 50 employees and up, were geo-coded to a point, which in some cases required manual placement of points for their sites.

Final Verification

The final activity of the verification process was to create lists of major employers for review by MAG member cities. Feedback from these members was then incorporated into the data.

To summarize, the basic steps for this task included:

- Searching for duplicate entries and non-functional addresses;
- Printing sorted survey lists;
- Conducting the telephone survey;
- Estimating employment for chain operations;
- Updating employer records;
- Resolving address problems;
- Geo-coding employer records; and
- Providing lists of major employer records for member review.

4.0 EMPLOYER DATABASE DEVELOPMENT

This section describes the tasks involved in assembling, then refining and enhancing the raw employer site data. The employer database verification and geo-coding process used by the consultant team is explained, and the resultant employer database. A description of processes and methods used in surveying and verifying site employment is included, as well as a description of data issues that arose during the process, and the methods used to resolve them. The geo-coding process is described, along with the results. Finally, a summary of the employment database resulting from these tasks is included.

4.1 DATABASE ASSEMBLY

Based on the review and evaluation of available employer data, and the methodologies developed in previous tasks, a set of employer data was purchased from Dun & Bradstreet in November, 1995. This data set, which contained employer site records with employment at each address, served as the primary source of information for the employer database.

The initial examination of the Dun & Bradstreet data showed that the file contained records for 87,140 establishments in Maricopa County totaling 1,112,606 employees. Records appeared to be generally complete, with all having SIC codes, and 83,070 having 9 digit ZIP codes.

The 1,112,606 employee total included on the raw Dun & Bradstreet file was 161,894 fewer employees than the Arizona Department of Economic Security (DES) estimates for Maricopa County for October 1995. The largest variance occurred in public sector employment, which was expected since Dun &Bradstreet's focus is on the private sector of the economy. Dun & Bradstreet employment figures were very close to DES estimates in both the smallest and largest segments of the labor force, i.e. mining and services. The largest discrepancies were in manufacturing employment and government (including education).

While the Dun & Bradstreet data served as the base of data for this project it was not considered to be an exclusive source of data. It was expected that there would be omissions and errors in the Dun & Bradstreet data file and so additional files were selected to complement the Dun & Bradstreet data.

Auxiliary files utilized by Applied Economics to compile the employer database included:

- Maricopa County Trip Reduction (2 related files):
  Companies with 1,259 records and
  Sites with 2,421 records;
- 1993 MAG Employment Database with 3200 records;
- Kammrath & Associates Retail database with 11,399 records;
- Leadsource Arizona Commercial Directory

In some cases a particular file was used as a method of comparison to the Dun & Bradstreet data to identify areas where errors or omissions appeared to be present. For example, a comparison with Leadsource data indicated a number of omissions of stores in retail chains in the Dun & Bradstreet file. Comparison with the County Trip Reduction file also revealed omissions for both public and private sectors employers. Kammrath & Associates data was used to add 225 records for retail chains. Maricopa County Trip Reduction data was used to add an additional 172 individual employment sites to the master file.

Both the County Trip Reduction files and the 1993 MAG file were used to search for problem areas in public sector employment, particularly schools. Unexpectedly, the raw Dun & Bradstreet file appeared to have good coverage for schools, though in some cases the employment data was very poor and was given particular attention during the verification process. These same two auxiliary data files were utilized during the verification procedures in Task 5 to help ensure comprehensiveness and accuracy in the records for public sector sites.

The original employer file contained 87,542 records. It was known that a number of these records would be marked for deletion since Dun & Bradstreet frequently lists departments within the same business site as individual records. The employer records are stored in a single database table called "Employ." The database file has three basic types of fields: fields for maintaining integrity and organization during the verification process; fields for basic site data; and fields to store geographic data.

4.2 DATABASE VERIFICATION

Examination of the Dun & Bradstreet data revealed that many records existed for divisions within the same company at the same location. Only employment sites with 50 or more employees were to be surveyed, but in many cases the Dun & Bradstreet data included two or more listings for one business site. Each listing had less than 50 employees, but when combined had 50 or more. These records were grouped, marked, and included in the verification process. Records for government agencies at all levels and public educational institutions were marked to be verified separately from private companies.

As part of a continuing process, the database was sorted and/or grouped by phone number, name, address (or the first part of the address, in order to compensate for abbreviations or suite numbers), and Standard Industrial Classification (SIC) code in various combinations. Rather than searching for duplicate entries as one large process it was determined that a more accurate method would be to conduct smaller, defined searches at several points, so as to be continually comparing new and/or updated information. Also, it was necessary to group records in various ways to compensate for the fact that Dun and Bradstreet has inconsistent conventions for listing business names and abbreviating names.

A more recent version of the Maricopa County Trip Reduction database than the one used for identifying additional business sites in Task 4, was acquired. This database included the survey dates for each of the companies listed. There was no convincing reason to survey companies that had only recently undergone a systematic, 100 percent count survey. Therefore we identified those surveyed in late fall and winter and matched them to the master file by telephone number and/or address. Employment data from the Trip Reduction database was utilized if there was a clear match, i.e. if the data was for a single site and not a group of sites. Recent data from the Business Journal was used in a few (44) cases to update records, primarily law and engineering firms, that were known to be difficult businesses from which to acquire data through telephone survey.

TELEPHONE SURVEY

Telephone surveying on the remaining records began on December 18, 1995, and was essentially completed by March 15, 1996, with only a few specific records followed up on after that time. Five different people performed survey work, though not all at the same time or to the same extent. A written set of instructions was given to these surveyors to aid in answering questions, and to obtain accurate information.

All records to be verified by phone survey were sorted by SIC groups at the 2-digit level. The purpose was to have a surveyor working with similar types of industries at one time and be better able to note any trends in data issues that might be specific to a particular industry. In addition, since the industry group was printed on the survey forms along with the company names, it was easier to note cases of misclassification of industry SIC code. This method of grouping also allowed greater control of timing when a particular industry would be surveyed. For example, it was decided to not survey hotels and resorts just prior to the New Year's holiday as a courtesy to those businesses.

Twenty batches were created. Sixteen were industry groupings, generally of about 150 records in each. Four batches were considered special cases, such as companies with very large numbers of employees, numerous sites, or multiple records with the same telephone number. Further refinement was accomplished whenever possible by grouping company locations even when there were no matching telephone numbers or SIC codes.

Batch reports were printed, including the SIC group and short title, the company name, secondary name (if any), address, city, telephone number, and the currently recorded employment. Surveyors were instructed to verify employment and address, and note any other changes, such as the business name. While notes were sometimes made about other locations of a company operation, the surveyors were instructed to be specific about requesting information for the particular site in question. Batch reports were printed only when ready to be surveyed to reflect any updates to the data provided from other sources. An example of a batch report is shown in Figure 8.

For records not verified due to the lack of a correct telephone number, the telephone directory was consulted for a more current number, and the records were returned to the surveyor. When no listing could be found for a business, through searches on primary and secondary business name, or within that industry group in the Yellow Pages, the business was generally assumed to be closed and marked for deletion.

FIGURE 6
EXAMPLE SURVEY BATCH REPORT

Surveyor: _____	Survey Dates: _____	Completed Calls: _____		
Business Name	**Address**	**City**	**Telephone**	**Employees**
BATCH: A4	Thursday, April 25, 1996			
GroupSIC: 20	**Food and kindred products**			
BAR-S FOODS CO -	4041 N CENTL AVE STE 1300	PHOENIX	264-7272	60
HUNT-WESSON INC - ROSARITA MEXICAN FOODS CO	310 S EXTENSION RD	MESA	964-8751	215
J & J MEXICAN FOOD PDTS LTD - ESTRELLA TORTILLA FACTORY	1004 S CENTRAL AVE	PHOENIX	253-5947	50
SCHREIBER FOODS INC -	2122 S HARDY DR	TEMPE	967-2195	53
SIC Group: 20	**Records: 4**		**Employees:**	**378**
GroupSIC: 23	**Apparel and other textile products**			
COLLEGEVILLE-IMAGINEERING -	6025 W MONROE ST	PHOENIX	269-9391	130
DASH DESIGNS INC - DASH CONCEPTS	600 W 24TH ST	TEMPE	967-2678	125
PHOENIX TENT & AWNING CO -	1610 E YALE ST	PHOENIX	225-0939	50
ROBERTSON FACTORIES INC -	16646 E LASER DR	SCOTTSDALE	837-1060	60
WHATS NEW LTD -	3716 E MAIN ST	MESA	830-4581	80
SIC Group: 23	**Records: 5**		**Employees:**	**445**
GroupSIC: 24	**Lumber and wood products**			
BASS CABINET MANUFACTURING -	503 W 3RD AVE	MESA	962-5249	50
MEYER & LUNDAHL MFG CO -	2345 W LINCOLN ST	PHOENIX	254-9286	65
SUNBURST SHUTTERS INC -	3637 E MARICOPA FWY	PHOENIX	275-0400	50
SIC Group: 24	**Records: 3**		**Employees:**	**165**
Number of Records in Batch: A4		**12**		

Large grocery and restaurant chains were sample surveyed, that is, several locations for each company were surveyed and the remaining stores' employment estimated on that basis. Surveyors were instructed to call locations in a wide geographic range, to call all where the D&B-reported employment was considerably larger or smaller than the majority, and to keep calling until a clear pattern could be noted. The majority of these businesses were contacted directly. Only 246 sites were ultimately assigned with an employment estimate based on this part of the survey.

DATABASE UPDATE

As surveys were completed, or data was obtained from a secondary source, it was input on the master file. The date of last record update was recorded automatically, as was a code to specify which surveyor provided the employment data for the record. This method was used so that the combination of "Batch" and "Verify" fields would make it simple to refer back to the original survey if any questions arose. This database field, "Verify", was input for all records. It indicated whether or not a record was verified, and if so, by what means or source of data.

When information from the telephone survey was input for large businesses, or for businesses with large changes from the original data, reference was made to other sources in order to evaluate the accuracy of the data whenever possible. This step was taken due to the possibility of miscommunication by a company giving an employment figure for all locations rather than a specific site.

Sources utilized for cross-checking survey data included the Maricopa County Trip Reduction database, the Business Journal, the Arizona High-Tech Directory, and the Arizona Industrial Directory. In cases where such inconsistencies were noted the companies were re-contacted for clarification and/or to acquire more specific site data. In a few cases where there was some discrepancy as to whether or not an employment site was operational, a field check was done to verify location and activity at the location in question.

The various searches and groupings conducted on the original database indicated some gaps in coverage not identified prior to the verification process. While the telephone survey was being conducted, other data was acquired and utilized to add sites and/or to verify employment on the database. Database files were acquired from the Arizona Department of Education, the City of Phoenix, and the State of Arizona Trip Reduction Program. Data from the Department of Education was used to add 63 school sites to the database, and used in conjunction with the County Trip Reduction data to provide site specific employment. Data from the City of Phoenix and the State was used to verify employment and location of government offices, and to add records to the database.

Through the verification process, 5,817 records from original data set were verified or deleted. Additional sources of employer information were used to add 823 sites with employment of 73,592 persons to the database. As shown on Table 1, records were added from seven different sources. The largest number were from the City of Phoenix, Kammrath & Associates, and the Maricopa County Trip Reduction Program. It should be noted that sometimes records were added, and later discovered to be duplicates. This occurred due to address changes or discrepancies in business names, and is one of the reasons Applied Economics conducted multiple searches for duplicates. The summary only liststhe counts for records retained in the final database.

TABLE 1
UN-GEOCODED EMPLOYER DATABASE
ESTABLISHMENTS AND EMPLOYMENT BY DATA SOURCE

Record Source	Establishments	Percent of Total	Employment	Percent of Total
Total	**86,342**	**100%**	**1,061,007**	**100%**
Dun & Bradstreet	**85,519**	**99.05%**	**987,415**	**93.06%**
Cities	284	0.33%	13,354	1.26%
Kammrath & Assoc.	222	0.26%	9,961	0.94%
Maricopa County	212	0.25%	31,028	2.92%
Dept. of Education	63	0.07%	4,578	0.43%
Applied Economics	20	0.02%	11,627	1.10%
State of Arizona	18	0.02%	2,708	0.26%
Business Journal	4	0.00%	336	0.03%
Records Added	**823**	**0.95%**	**73,592**	**6.94%**

Source: Applied Economics, 1996.

TABLE 2
UN-GEOCODED EMPLOYER DATABASE
ESTABLISHMENTS AND EMPLOYMENT BY VERIFICATION METHOD

Verification	Establishments	Percent of Total	Employment	Percent of Total
Total	**86,342**	**100%**	**1,061,007**	**100%**
Non-verified	82,155	95.15%	461,203	43.47%
Would Not Disclose	9	0.01%	1,171	0.11%
Not Able to Contact	1	0.00%	50	0.00%
Other Non-verified	10	0.01%	1,221	0.12%
Surveyed	**2,550**	**2.95%**	**383,298**	**36.13%**
Maricopa County	1,081	1.25%	168,749	15.90%
Cities	23	0.03%	472	0.04%
Estimated	246	0.28%	16,913	1.59%
Dept. of Education	149	0.17%	10,039	0.95%
State of Arizona	84	0.10%	14,113	1.33%
Business Journal	44	0.05%	4,999	0.47%
Other Verification	**1,627**	**1.88%**	**215,285**	**20.29%**
Deletions *	**1,640**		**120,149**	

Source: Applied Economics, 1996.

* Not included in Total

As shown on Table 2 (on previous page), over 1,600 records were ultimately marked for deletion. In some cases address verification showed that a business was actually located outside of Maricopa County. In most cases the records were duplicates. For example, Dun and Bradstreet listed approximately 50 records for the Arizona State University main campus. In other cases a business underwent a name change, and Dun and Bradstreet retained the old record while adding the new name as an additional record. Dun and Bradstreet also sometimes listed several business sites, but included all the employment at one of them, i.e. double counting the employment. Most notably, this was done with both Motorola and Allied Signal.

Of the 86,344 records remaining after the additions and deletions, 82,155 were for employment sites of less than 50 employees and were not verified. Direct telephone surveys were conducted for verification of 2,550 sites with 383,298 employees, approximately 36 percent of the total database employment. An additional 1,627 sites with 215,285 employees were verified from other sources, for a combined total of 4,177 verified records with 598,583 employees, or approximately 56 percent of the total database employment. There were 10 businesses on lists to be verified that would not provide information during initial contact or in follow-up contact.

4.3 GEO-CODING

The object of the geo-coding task was to assign an XY coordinate to each employer record. Coordinates were assigned using the Arizona Central State Plane coordinate system, and were based on MAG's street file "MAGNET." Whenever possible, the XY coordinate was to be assigned using standard MapInfo geo-coding methods. The preferred method was to place the address at its interpolated location within a MAGNET address range, refined using MAGMPA boundaries as an overlay boundary.

MAG staff started work on this process by geo-coding 77,622 records, out of a file of 87,544 records, using totally automated methods. The sub-contractor assigned to geo-code the remaining records, received 9,922 records that required XY coordinates to be assigned to them by other means. Of these 9,922 records, 898 included "PO Box" addresses. Those addresses were not geocoded as a part of this task as per discussions with MAG staff. This resulted in 9,024 records remaining to be geocoded (See Table 3 for a summary geo-coding success statistics).

Since the 9,024 records would not geo-code automatically, there were two major types of revisions required in order to match the employer records to MAGNET:

- Corrections to employer information (additions/changes/deletions) were applied, as necessary, to every element of the employer file addresses. Edits were made to: street numbers, street directions, basic street names (especially spelling), street types, and MPAs to match the address to MAGNET.

TABLE 3
EMPLOYER DATABASE
GEO-CODING SUCCESS STATISTICS

Record Group	Count	Percent	Description
All Records	87,544	100.0%	Total records in database when the geocoding process began
Geocoded by MAG	77,622	88.7%	Records which geocoding using totally automated procedures
Total - MAG Geocoded	9,922	11.3%	Number of records sent to consultant for geocoding
Post Office Boxes	898	1.0%	Post office boxes (with site employment of less than 50)
Total - MAG - PO Boxes	9,024	10.3%	Records to be geocoded by consultant
Consultant Geocoded:	8,176	9.3%	
Address Changes	7,422	8.5%	Geocoded by correcting employer file's addresses to an address recognizeable by MapInfo, using the MAGNET, MAGMPA and 5 digit zipcode files.
New Points	754	0.8%	Geocoded by placing employer address at one of 146 newly created points, placed accurately relative to MAGNET
Not Geocoded:	848	0.9%	
Bad Records	230	0.2%	Address documented as impossible to geocode without further research (telephoning, etc.); also, employer addresses irrelevant to the project, such as New York City or Casa Grande
Problem Records	618	0.7%	Addresses to which many types of cleanup methods were applied, which would still not geocode. Many of these belong in the "bad records" category, above, but were not documented as such. Some, however, may be possible to geocode based upon other geographic clues
Total Not Geocoded (P.O. Boxes and Not Geocoded)	1,746	1.9%	

Source: Sandra Weir, AICP, 1996.

- Corrections were made due to errors in MAGNET street coding. Since the task did not include updates to the MAGNET file, corrections due to MAGNET errors and omissions were handled by placing new points where MAGNET lacked street segments. The placement of these points was guided by MAGNET's existing streets and the Thomas Guide, Phoenix Metropolitan Area, 1996 Edition. In many instances, employer addresses had to be geocoded to nearby MAGNET segments, because the MAGNET segments in the proper locations had improper street directions or address ranges assigned to them.

Major data sources used in addition to the employer file, MAGNET, and MAGMPA were: the Thomas Guide, Phoenix Metropolitan Area , 1996 editio; the Phoenix business white pages telephone book; and the 5-digit zip code MapInfo layer derived from the Maricopa County DOT's ARC/INFO zip code coverage. The zip code coverage, which is registered to another street coverage STREETNET, was only used to group un-geocoded site records together geographically to aid the geo-coding process. Of course, the MAGTAZ MapInfo layer was viewed during MapInfo tasks, so that any points that had to be approximated were placed within the correct TAZ.

Through these processes 8,176 of the 9,024 records were geo-coded by the consultant. All records for sites with over 50 employees were geo-coded. The records not geo-coded fell into two groups. The first group, which contained about 200 site records, did not have useful information in the address fields. These records had address information such as "North Physical Address" or "Valley-wide" or "Center of Town." The other group, which contained about 600 site records, included records to which many types of cleanup methods were applied, but that still would not geo-code. Some were possible to geo-code based upon geographic clues.

Overall, of the 87,544 records included in the database when the geo-coding process began, only 1,746 (1.9 percent) were not geo-coded. The un-geocoded records consisted of 898 post office box address records, and about 848 records for small businesses with very poor or missing address information. The sub-consultant on this task successfully geocoded over 8,100 records by correcting address information, and adding new points consistent with the MAGNET street network.

4.4 SUMMARY OF RESULTS

The final employer database was compiled by merging the files from the verification and geo-coding tasks, which were performed in parallel. Through this merging process about 570 records were added, or had address information updated based on the verification process. The resulting database had a total of 87,982 site records of which 1,640 were marked for deletion. By comparing the 1,640 records marked for deletion with the 1,746 records that did not geo-code, 136 un-geocoded records were removed from the list leaving only 1,610 records un-geocoded.

The final database was compiled by removing records marked for deletion, and those that did not geo-code, leaving 84,732 site records on the database (87,982 - 1,640 - 1,610). The description of the final database record, and the meaning of the codes used is shown in Figures 7 and 8.

FIGURE 7
TABLE DESCRIPTION
MAG EMPLOYER DATABASE

Table Name:	EMPLOYER	Total Record Count:	87,982
Table creation date:	11/29/95	Net* Record Count:	84,732
Last table alteration:	6/15/96		

Field Name	Type	Size	Description
ID	Number (Counter)	4	Applied Economics record ID number.
DunNumber	Text	9	Dun & Bradstreet record ID number.
LASTUP	Date/Time	8	Last record update.
BATCH	Text	4	Survey group.
DRFLAG	Text	4	Record handling flag.
SOURCE	Text	12	Record data source.
VERIFY	Text	10	Type of record verification.
BusName	Text	30	Business name.
BusName2	Text	30	Secondary business name.
Address	Text	30	Business site address.
AddSource	Text	10	Source of address.
City	Text	20	Business site city.
CityShort	Text	2	City code used for geocoding.
State	Text	2	Business site state.
ZipCode	Text	9	Business site Zip code.
Area	Text	3	Telephone area code.
Telephone	Text	7	Telephone number.
TelephoneOld	Text	10	Telephone number with area code.
MfgFlg	Text	1	Manufacturing at site; 0 = Yes, 1 = No.
SIC1	Text	8	Primary SIC code, 8 digit.
SIC2	Text	8	Secondary SIC code, 8 digit.
EmpNum	Number (Double)	8	Number of employees at site
OutEmp	Number (Double)	8	Number of employees working off-site.
XCOORD	Number (Double)	8	X geographical coordinate.
YCOORD	Number (Double)	8	Y geographical coordinate.
TAZ	Text	4	Traffic Analysis Zone.
RAZ	Text	3	Regional Analysis Zone.
MPA	Text	2	Metropolitan Planning Area.
4DSIC	Text	4	Secondary SIC code, 4 digit.
INDGRP	Number	1	Industry Grouping based on 4DSIC
LANDUSE	Number	1	Primary Land Use Code
LANDUSE2	Number	1	Final Land Use Code (by assignment model)
ADJEMPNUM	Number	8	Adjusted (Benchmarked) employment at site
Note	Text	100	Record notes.

Source: Applied Economics, 1996.

* After deletions and non-geocoded records are removed.

FIGURE 8
DATABASE CODES AND DESCRIPTIONS
MAG EMPLOYER DATABASE

Field: SOURCE	Data Source Code
Dun & Bradstreet	DUNS
Cities	CITY
Kammrath & Assoc.	KAMM
Maricopa County	TRIP or TRP
Dept. of Education	EDUC
Applied Economics	DR
State of Arizona	STRP
Business Journal	BUSJ

Field: VERIFY	Verification Code
Deletions	DEL
Non-verified	NV
Would Not Disclose	WND
Not Able to Contact	NA
D. Graves	DR
Debra Seeburg	DS1
Debra Seeburg	DS2
Daniel Tomasik	DT
Daniel Tomasik	DT1
Julie Bishop	JB1
Mary Hawkins	MH1
Mary Hawkins	MH2
Mary Hawkins	MH3
Mary Hawkins	MH4
Mary Hawkins	MH5
Mary Hawkins	MH6
Maricopa County	TRP
Cities	CITY
Estimated	EST
Dept. of Education	EDUC
State of Arizona	STRP
Business Journal	BUSJ

Source: Applied Economics, 1996.

Table 4 shows the source of the records included in the final database. Of the 84,732 records, about 99 percent came from the original Dun & Bradstreet file. However, the 1 percent of records added through the verification process added 7.0 percent to total employment coverage. Table 5 shows the verification method applied to the records in the final database. While only about 5 percent of the records were verified, these records accounted for about 57 percent of total employment.

Table 6 shows the breakdown of establishments and employment by city from the final employer database. As expected, the City of Phoenix accounted for approximately half the employment in Maricopa County, with Scottsdale, Tempe, and Mesa each accounting for approximately 10 percent of County employment. Those four cities combined account for approximately 83 percent of the employment in the database.

Table 7 shows the makeup of the final Employer Database by industry, as identified by 2-digit SIC code, and compared to July 1995 Wage and Salary employment figures from the Arizona Department of Economic Security (DES). Overall, the database includes 92.5 percent, or all but about 86,300, of the Wage and Salary employees in Maricopa County. The database also shows good coverage by industry group. It achieves a very close approximation of DES wage and salary employment figures in the government, manufacturing and service sectors, with 97.4 percent, 97.2 percent and 92.4 percent of the DES estimates, respectively. The database also accounts for at least 85.0 percent of employment in the construction, trade and FIRE (Finance, Insurance & Real Estate) industry sectors. The largest discrepancies are in the agriculture and mining industry groups, which are the smallest and most difficult to track.

TABLE 4
FINAL EMPLOYER DATABASE
ESTABLISHMENTS AND EMPLOYMENT BY DATA SOURCE

Record Source	Establishments	Percent of Total	Employment	Percent of Total
Total	**84,732**	**100%**	**1,063,977**	**100%**
Dun & Bradstreet	**83,909**	**99.03%**	**982,376**	**92.33%**
Cities	286	0.34%	13,534	1.27%
Kammrath & Assoc.	221	0.26%	9,950	0.94%
Maricopa County	212	0.25%	31,117	2.92%
Dept. of Education	63	0.07%	4,578	0.43%
Applied Economics	19	0.02%	19,378	1.82%
State of Arizona	18	0.02%	2,708	0.25%
Business Journal	4	0.00%	336	0.03%
Records Added	**823**	**0.97%**	**81,601**	**7.67%**

Source: Applied Economics, 1996.

TABLE 5
FINAL EMPLOYER DATABASE
ESTABLISHMENTS AND EMPLOYMENT BY VERIFICATION METHOD

Verification	Establishments	Percent of Total	Employment	Percent of Total
Total	**84,732**	**100%**	**1,063,977**	**100%**
Non-verified	80,549	95.06%	456,090	42.87%
Would Not Disclose	9	0.01%	1,171	0.11%
Not Able to Contact	1	0.00%	50	0.00%
Other Non-verified	10	0.01%	1,221	0.11%
Surveyed	**2,542**	**3.00%**	**376,673**	**35.40%**
Maricopa County	1,077	1.27%	168,179	15.81%
Cities	33	0.04%	15,802	1.49%
Estimated	245	0.29%	16,902	1.59%
Dept. of Education	148	0.17%	9,998	0.94%
State of Arizona	84	0.10%	14,113	1.33%
Business Journal	44	0.05%	4,999	0.47%
Other Verification	**1,631**	**1.92%**	**229,993**	**21.62%**

Source: Applied Economics, 1996.

TABLE 6
FINAL EMPLOYER DATABASE
ESTABLISHMENTS AND EMPLOYMENT BY MAIL CITY

City	Establishments No.	% Tot.	Employment No.	% Tot.	City	Establishments No.	% Tot.	Employment No.	% Tot.
Total	**84,732**	**100%**	**1,063,977**	**100%**					
Aguila	15	0.02%	69	0.01%	New River	4	0.00%	5	0.00%
Arlington	6	0.01%	43	0.00%	Palo Verde	7	0.01%	2,920	0.27%
Avondale	257	0.30%	2,348	0.22%	Paradise Valley	56	0.07%	234	0.02%
Buckeye	315	0.37%	3,721	0.35%	Peoria	1,233	1.46%	12,936	1.22%
Carefree	208	0.25%	1,472	0.14%	Phoenix	40,098	47.32%	545,745	51.29%
Cashion	16	0.02%	288	0.03%	Queen Creek	85	0.10%	2,594	0.24%
Cave Creek	370	0.44%	2,142	0.20%	Rio Verde	7	0.01%	110	0.01%
Chandler	2,932	3.46%	46,248	4.35%	Salt River Res.	3	0.00%	28	0.00%
Chandler Hts	7	0.01%	17	0.00%	Scottsdale	12,081	14.26%	113,691	10.69%
El Mirage	107	0.13%	994	0.09%	Sun City	779	0.92%	8,258	0.78%
Fountain Hills	374	0.44%	2,007	0.19%	Sun City West	239	0.28%	2,212	0.21%
Gila Bend	68	0.08%	764	0.07%	Sun Lakes	1	0.00%	89	0.01%
Gilbert	1,283	1.51%	13,619	1.28%	Surprise	176	0.21%	1,635	0.15%
Glendale	4,891	5.77%	58,277	5.48%	Tempe	7,685	9.07%	118,312	11.12%
Goodyear	197	0.23%	4,290	0.40%	Tolleson	172	0.20%	4,312	0.41%
Guadalupe	21	0.02%	205	0.02%	Tonopah	10	0.01%	75	0.01%
Higley	71	0.08%	834	0.08%	Tortilla Flat	2	0.00%	40	0.00%
Laveen	90	0.11%	779	0.07%	Waddell	44	0.05%	173	0.02%
Litchfield Park	142	0.17%	1,698	0.16%	Wickenburg	347	0.41%	2,775	0.26%
Mesa	10,140	11.97%	106,651	10.02%	Wittmann	24	0.03%	249	0.02%
Mobile	1	0.00%	7	0.00%	Youngtown	159	0.19%	1,076	0.10%
Morristown	9	0.01%	35	0.00%					

Source: Applied Economics, 1996.

TABLE 7
FINAL EMPLOYER DATABASE
EMPLOYMENT BY INDUSTRY COMPARISON TO DES WAGE AND SALARY EMPLOYMENT

SIC	Short Title	Employer Database		DES Wage & Salary	Amount Difference	Percent Difference
		Establishments	Employment			
	TOTAL	**84,732**	**1,063,977**	**1,150,261**	**-86,284**	**-7.5%**
01	Agricultural production-crops	222	2,421			
02	Agricultural Production-Livestock	161	1,353			
07	Agricultural services	1,331	8,736			
08	Forestry	15	264			
09	Fishing, hunting, and trapping	1	6			
	Agriculture, Forestry, Fishing	**1,730**	**12,780**	**19,261**	**-6,481**	**-33.6%**
10	Metal mining	22	567			
12	Coal mining	16	41			
13	Oil and gas extraction	43	211			
14	Nonmetallic minerals, except fuels	28	438			
	Mining	**109**	**1,257**	**1,000**	**257**	**25.7%**
15	General contractors and builders	2,233	14,874			
16	Heavy construction, ex. building	333	7,408			
17	Special trade contractors	4,570	47,848			
	Construction	**7,136**	**70,130**	**78,300**	**-8,170**	**-10.4%**
20	Food and kindred products	184	7,619			
21	Tobacco products	2	30			
22	Textile mill products	58	586			
23	Apparel and other textile products	211	2,498			
24	Lumber and wood products	228	5,294			
25	Furniture and fixtures	234	4,742			
26	Paper and allied products	61	1,666			
27	Printing and publishing	1,047	11,284			
28	Chemicals and allied products	178	6,440			
29	Petroleum and coal products	24	194			
30	Rubber and misc. plastics products	194	5,787			
31	Leather and leather products	28	572			
32	Stone, clay, and glass products	185	3,079			
33	Primary metal industries	84	2,959			
34	Fabricated metal products	456	8,915			
35	Industrial machinery and equipment	776	15,086			
36	Electronic & other electric equipment	398	45,794			
37	Transportation equipment	185	19,110			
38	Instruments and related products	197	8,727			
39	Miscellaneous manufacturing industries	450	5,253			
	Manufacturing	**5,180**	**155,635**	**151,400**	**4,235**	**2.8%**
40	Railroad transportation	4	30			
41	Local and interurban passenger transit	102	2,045			
42	Trucking and warehousing	1,024	14,473			
44	Water transportation	16	106			
45	Transportation by air	127	10,285			
46	Pipelines, except natural gas	2	26			
47	Transportation services	724	9,255			
48	Communication	211	6,553			
49	Electric, gas, and sanitary services	259	7,930			
	Trans., Comm., & Public Utilities	**2,469**	**50,703**	**61,200**	**-10,497**	**-17.2%**

TABLE 7 (Continued)
FINAL EMPLOYER DATABASE
EMPLOYMENT BY INDUSTRY COMPARISON TO DES WAGE AND SALARY EMPLOYMENT

SIC	Short Title	Employer Database		DES Wage	Amount	Percent
		Establishments	Employment	& Salary	Difference	Difference
50	Wholesale trade - durable goods	4,924	43,692			
51	Wholesale trade - nondurable goods	2,094	20,743			
52	Building materials & garden supplies	699	6,201			
53	General merchandise stores	237	27,241			
54	Food stores	1,611	33,587			
55	Automotive dealers & service stations	1,633	22,562			
56	Apparel and accessory stores	1,377	7,358			
57	Furniture and homefurnishings stores	1,900	10,796			
58	Eating and drinking places	2,957	52,725			
59	Miscellaneous retail	5,249	29,026			
	Trade	**22,681**	**253,931**	**278,000**	**-24,069**	**-8.7%**
60	Depository institutions	559	13,037			
61	Nondepository institutions	531	7,791			
62	Security and commodity brokers	475	4,214			
63	Insurance carriers	247	9,649			
64	Insurance agents, brokers, & service	2,146	12,640			
65	Real estate	5,194	29,401			
67	Holding and other investment offices	406	1,797			
	Finance, Insurance, & Real Estate	**9,558**	**78,529**	**90,700**	**-12,171**	**-13.4%**
70	Hotels and other lodging places	364	22,000			
72	Personal services	3,659	17,170			
73	Business services	6,745	67,548			
75	Auto repair, services, and parking	2,636	16,319			
76	Miscellaneous repair services	1,632	7,412			
78	Motion pictures	489	2,900			
79	Amusement & recreation services	1,172	15,261			
80	Health services	6,082	82,035			
81	Legal services	2,318	15,797			
83	Social services	1,502	15,805			
84	Museums, botanical, zoological gardens	49	544			
86	Membership organizations	2,483	15,831			
87	Engineering & management services	4,958	36,563			
89	Services, nec	177	761			
	Services	**34,266**	**315,946**	**342,000**	**-26,054**	**-7.6%**
82	Educational services	1,025	70,444			
43	U.S. Postal Service	35	5,824			
91	Executive, Legislative, and General	371	29,814			
92	Justice, Public Order, and Safety	36	4,744			
93	Finance, Taxation, and Monetary Policy	13	2,477			
94	Administration of Human Resources	39	5,638			
95	Environmental Quality and Housing	31	2,365			
96	Administration of Economic Programs	40	2,792			
97	National Security and International Affairs	13	968			
	Government	**1,603**	**125,066**	**128,400**	**-3,334**	**-2.6%**

Source: Applied Economics, 1996; Arizona Department of Economic Security,
Arizona's Workforce, December 19, 1995.

5.0 EMPLOYMENT ESTIMATES

This chapter describes the development of small-area (TAZ) employment estimates based on the Employer Database. It reviews of the development of County-level control totals of employment by industry, and industry-specific benchmarking factors developed for application to employer site records in the Employer Database. The chapter also reviews the problems associated with assigning employers to land uses based on their industry, and the approach developed by Applied Economics to solve those problems. Finally the chapter introduces the employment estimates resulting from this process. Tables are provided that show estimated 1995 employment by land use for Municipal Planning Areas and Regional Analysis Zones.

5.1 CONTROL TOTALS AND BENCHMARKING

CONTROL TOTALS BY INDUSTRY

The goal of this part of the analysis was to create DES-based estimates of **total** employment by industry group. These estimates were required to bench-mark employment by industry in the Employer Database to reflect County total employment and industrial composition. It was necessary to estimate these industry group totals since the industry detail provided by DES (the desired source for County-level employment) reflects only Wage and Salary employees. The difference between Wage and Salary and Total employment is composed primarily of self-employed persons, and persons working without cash pay (usually in family businesses).

In addition, the potential for domestic workers to comprise part of the un-accounted for employment was also explored. However, the idea of accounting for these workers was dismissed when (1) they were revealed to represent only 0.4 percent of total employment based on data from the Census Transportation Planning Package; and (2) investigation revealed that many work through services that probably are on the Employer Database, although the employment was likely assigned to the TAZ where the service's office is located.

The Census Public Use Microdata Sample (PUMS) file was used to analyze the incidence of self-employed and family workers by industry group. Table 8 shows the breakdown of workers from the 1980 and 1990 PUMS (5 percent) survey by employee class for major industry groups. Employee classes identify persons working for pay in private business and government, and those who are self-employed or work without (cash) pay. The final column in Table 8 shows the proportion of workers in each industry group that would be reported in Wage & Salary employment estimates, a "report ratio."

Next, the change in the report ratio by industry from 1980 to 1995 were used to estimate report ratios for 1995. Table 9 shows the results of performing a straight-line extension of the change in report ratio by industry out to 1995. In general the data shows a downward trend in report ratios implying a greater level of self/family employment. In fact, 5 of the 8 private-sector industry groups experienced increased rates of self-employment between 1980 and 1990. Only agriculture and trade show increasing report ratios, indicative of the loss of small, "mom and pop," businesses in these industry groups.

TABLE 8
EMPLOYMENT BY INDUSTRY BY EMPLOYEE CLASS FOR EMPLOYED PERSONS BASED ON FIVE PERCENT SAMPLE OF MARICOPA COUNTY HOUSEHOLDS

		"Reported"		"Unreported"		
	Total	Private	Public	Self-Employed	Without Pay	Report Ratio
1980						
Agriculture	15,300	11,500	560	3,040	200	78.8%
Mining	2,120	1,980	20	120	-	94.3%
Construction	56,100	48,900	2,060	4,840	300	90.8%
Manufacturing	119,140	116,000	680	2,320	140	97.9%
T.C.P.U. (1)	44,840	35,120	8,720	1,000	-	97.8%
Trade	147,480	136,700	940	8,720	1,120	93.3%
F.I.R.E. (2)	54,180	48,960	1,060	3,900	260	92.3%
Services	186,780	119,140	51,580	15,460	600	91.4%
Public Administration	35,420	-	35,420	-	-	100.0%
TOTAL	661,360	518,300	101,040	39,400	2,620	93.6%
1990						
Agriculture	19,428	14,812	567	3,719	330	79.2%
Mining	1,113	1,029	10	74	-	93.4%
Construction	62,547	52,995	3,176	5,994	382	89.8%
Manufacturing	148,935	143,839	978	3,853	265	97.2%
T.C.P.U. (1)	78,589	62,626	12,829	2,861	273	96.0%
Trade	224,758	210,761	1,298	11,646	1,053	94.3%
F.I.R.E. (2)	90,753	81,358	2,679	6,553	163	92.6%
Services	332,463	232,493	68,304	30,563	1,103	90.5%
Public Administration	45,849	16	45,833	-	-	100.0%
TOTAL	1,004,435	799,929	135,674	65,263	3,569	93.1%

Source: Bureau of the Census, Public Use Microdata Sample, Maricopa County, 1980 & 1990.

(1) T.C.P.U. = Transportation, Communication and Utilities
(2) F.I.R.E. = Finance, Insurance and Real Estate

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TABLE 9
ESTIMATED 1995 "REPORT RATIO" FOR EMPLOYED PERSONS
BASED ON EXTENSION OF 1980 TO 1990 TRENDS

	1980	1990	Est. 1995
Agriculture	78.8%	79.2%	79.3%
Mining	94.3%	93.4%	92.9%
Construction	90.8%	89.8%	89.3%
Manufacturing	97.9%	97.2%	96.9%
T.C.P.U. (1)	97.8%	96.0%	95.1%
Trade	93.3%	94.3%	94.9%
F.I.R.E. (2)	92.3%	92.6%	92.7%
Services	91.4%	90.5%	90.0%
Public Administration	100.0%	100.0%	100.0%

Sources:
Bureau of the Census, Public Use Microdata Sample, Maricopa County, 1980 and 1990.
Arizona Department of Economic Security, State Data Center, 1996.
Applied Economics, 1996.

(1) T.C.P.U. = Transportation, Communication and Utilities
(2) F.I.R.E. = Finance, Insurance and Real Estate

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The final step in developing control totals was to apply the 1995 estimated report ratios to the 1995 wage & salary employment estimates from DES. As shown in Table 10, applying the unadjusted report ratios caused total employment to be slightly under-estimated. It was necessary to adjust the report ratios downward slightly, from 93.3% to 90.0% overall to balance the total of employment by industry group to the DES estimate of 1,264,800. The adjusted, DES-based employment estimates in the final column of Table 10 were used as the control totals for benchmarking employment in the employer database.

Benchmarking

The process of benchmarking employment in the employer database began by aggregating employment by industry group from the employer database, and comparing that with the County control totals by industry, as shown in Table 11. Total employment in the database, about 1,063,977, represented about 83 percent of DES total employment. The rate of representation varies by industry group, but rarely falls below 75 percent.

Based on this level of representation, consideration was given to other methods for estimating where the missing employment was. An alternative to benchmarking employer database employment up to account for the 20 percent would have been to construct an estimate model that was based partly on land use and partly on the employer database. However, this approach was decided against for three main reasons:

TABLE 10
DEVELOPMENT OF JULY 1995 TOTAL JOBS ESTIMATES
MARICOPA COUNTY, ARIZONA

	DES Wage & Salary	Est. 1995 Report Ratio	Unadjusted DES-Based Total Jobs	Adjusted 1995 Report Ratio	DES-Based Adjusted Total Jobs
Agriculture	19,261	79.3%	24,281	77.1%	24,983
Mining	1,000	92.9%	1,077	90.2%	1,108
Construction	78,300	89.3%	87,692	86.8%	90,228
Manufacturing	151,400	96.9%	156,268	94.2%	160,787
T.C.P.U. (1)	61,200	95.1%	64,331	92.5%	66,191
Trade	278,000	94.9%	293,061	92.2%	301,536
F.I.R.E. (2)	90,700	92.7%	97,802	90.1%	100,630
Services	342,000	90.0%	379,949	87.5%	390,937
Government	128,400	100.0%	128,400	100.0%	128,400
Total	1,150,261	93.3%	1,232,859	90.9%	1,264,800

Sources:
DES Employment - Arizona Department of Economic Security, July 1995 Employment Estimates, 1995.
Report Ratio - Public Use Microdata Sample of Maricopa County, 1980 and 1990; Applied Economics, 1996.

(1) T.C.P.U. = Transportation, Communication and Utilities
(2) F.I.R.E. = Finance, Insurance and Real Estate

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- First, since the relationship between industry and land use is not clear, it would have been very difficult to estimate a better distribution for employers than we get with the employer data alone;

- Second, the density of employment (in terms of employees per developed acre) varies greatly, thus limiting the accuracy of calculated employment potential based on land use; and

- Third, MAG would lose the ability to easily re-assign employment to TAZs, as TAZ boundaries change over the next 6 months.

For these, and other reasons, it was decided that the employment at the employer-sites on the database would be adjusted to account for the "missing" employment. The final column of Table 11 shows the resulting "Bench Factor" applied to all employers in each industry group.

TABLE 11
COMPARISON OF JULY 1995 EMPLOYMENT ESTIMATES
MAG EMPLOYER DATABASE AND DES-BASED ESTIMATES

SIC	Short Title	Employer Database		DES-Based	Amount	Adjustment
		Establishments	Employment	Estimate	Difference	Factor
	TOTAL	**84,731**	**1,058,272**	**1,264,800**	**-206,528**	**1.195**
01	Agricultural production-crops	222	2,421			
02	Agricultural Production-Livestock	161	1,353			
07	Agricultural services	1,331	8,736			
08	Forestry	15	264			
09	Fishing, hunting, and trapping	1	6			
	Agriculture, Forestry, Fishing	**1,730**	**12,780**	**24,983**	**-12,203**	**1.955**
10	Metal mining	22	567			
12	Coal mining	16	41			
13	Oil and gas extraction	43	211			
14	Nonmetallic minerals, except fuels	28	438			
	Mining	**109**	**1,257**	**1,108**	**149**	**0.881**
15	General contractors and builders	2,233	14,874			
16	Heavy construction, ex. building	333	7,408			
17	Special trade contractors	4,570	47,848			
	Construction	**7,136**	**70,130**	**90,228**	**-20,098**	**1.287**
20	Food and kindred products	184	7,619			
21	Tobacco products	2	30			
22	Textile mill products	58	586			
23	Apparel and other textile products	211	2,498			
24	Lumber and wood products	228	5,294			
25	Furniture and fixtures	234	4,742			
26	Paper and allied products	61	1,666			
27	Printing and publishing	1,047	11,284			
28	Chemicals and allied products	178	6,440			
29	Petroleum and coal products	24	194			
30	Rubber and misc. plastics products	194	5,787			
31	Leather and leather products	28	572			
32	Stone, clay, and glass products	185	3,079			
33	Primary metal industries	84	2,959			
34	Fabricated metal products	456	8,915			
35	Industrial machinery and equipment	776	15,086			
36	Electronic & other electric equipment	398	45,794			
37	Transportation equipment	185	19,110			
38	Instruments and related products	197	8,727			
39	Miscellaneous manufacturing industries	450	5,253			
	Manufacturing	**5,180**	**155,635**	**160,787**	**-5,152**	**1.033**
40	Railroad transportation	4	30			
41	Local and interurban passenger transit	102	2,045			
42	Trucking and warehousing	1,024	14,473			
44	Water transportation	16	106			
45	Transportation by air	127	10,285			
46	Pipelines, except natural gas	2	26			
47	Transportation services	724	9,255			
48	Communication	211	6,553			
49	Electric, gas, and sanitary services	259	7,930			
	Trans., Comm., & Public Utilities	**2,469**	**50,703**	**66,191**	**-15,488**	**1.305**

TABLE 11 (Continued)
COMPARISON OF JULY 1995 EMPLOYMENT ESTIMATES
MAG EMPLOYER DATABASE AND DES-BASED ESTIMATES

SIC	Short Title	Employer Database		DES-Based	Amount	Adjustment
		Establishments	Employment	Estimate	Difference	Factor
50	Wholesale trade - durable goods	4,924	43,692			
51	Wholesale trade - nondurable goods	2,094	20,743			
52	Building materials & garden supplies	699	6,201			
53	General merchandise stores	236	19,841			
54	Food stores	1,611	33,587			
55	Automotive dealers & service stations	1,633	22,562			
56	Apparel and accessory stores	1,377	7,358			
57	Furniture and homefurnishings stores	1,900	10,796			
58	Eating and drinking places	2,957	52,725			
59	Miscellaneous retail	5,249	29,026			
	Trade	**22,680**	**246,531**	**301,536**	**-55,005**	**1.223**
60	Depository institutions	559	13,037			
61	Nondepository institutions	531	7,791			
62	Security and commodity brokers	475	4,214			
63	Insurance carriers	247	9,649			
64	Insurance agents, brokers, & service	2,146	12,640			
65	Real estate	5,194	29,401			
67	Holding and other investment offices	406	1,797			
	Finance, Insurance, & Real Estate	**9,558**	**78,529**	**100,630**	**-22,101**	**1.281**
70	Hotels and other lodging places	364	22,000			
72	Personal services	3,659	17,170			
73	Business services	6,745	67,548			
75	Auto repair, services, and parking	2,636	16,319			
76	Miscellaneous repair services	1,632	7,412			
78	Motion pictures	489	2,900			
79	Amusement & recreation services	1,171	15,211			
80	Health services	6,082	82,035			
81	Legal services	2,318	15,797			
83	Social services	1,502	15,830			
84	Museums, botanical, zoological gardens	49	544			
86	Membership organizations	2,483	15,831			
87	Engineering & management services	4,958	36,588			
89	Services, nec	177	761			
	Services	**34,265**	**315,946**	**390,937**	**-74,991**	**1.237**
82	Educational services	1,025	64,739			
43	U.S. Postal Service	35	5,824			
91	Executive, Legislative, and General	371	29,814			
92	Justice, Public Order, and Safety	36	4,744			
93	Finance, Taxation, and Monetary Policy	13	2,477			
94	Administration of Human Resources	39	5,638			
95	Environmental Quality and Housing	31	2,365			
96	Administration of Economic Programs	40	2,792			
97	National Security and International Affair	14	8,368			
	Government	**1,604**	**126,761**	**128,400**	**-1,639**	**1.013**

Source: Applied Economics, 1996; Arizona Department of Economic Security, Arizona's Workforce, December 19, 1995.

5.2 LAND USE ASSIGNMENTS

INDUSTRY TO LAND USE ALTERNATIVES

While the employer-site records on the database contain a Standard Industrial Classification (SIC) for each employer, the TAZ estimates required by MAG are for land use categores. MAG's employment land use categories include retail, office, industrial, public and other employment uses. Also, for the first time, allocation to the residential land use category was considered to account for the existence of home-based businesses.

The relationship between industry and land use may seem obvious at first, but one example clearly demonstrates the problem. If we were examining an employer in the mining industry we would expect to associate the operation with industrial, public or vacant land uses. However, Phelps Dodge (which is in the mining industry) has offices on Central Avenue where these land uses are scarce.

To address these problems, alternative land use designations were developed for groups of industries. Primary, secondary and tertiary land use designations were assigned to each industry group, defined by ranges of 4-Digit SICs, as shown in Table 12. These alternatives were used as the primary guide for re-assigning employers to other land use categories.

FINAL LAND USE ASSIGNMENTS

In general, the approach here was to process the employers in each TAZ, comparing their industry and primary land use designations with existing land use information by TAZ. Assignment of employers to land uses could then be based on a set of prescribed alternatives for each industry, and the land use characteristics of the TAZ.

To operationalize this analysis, a stand-alone assignment-testing model was created in the Pascal programming language. The program uses selected information exported from the Employer Database and other sources to quickly test re-assignment alternatives. Results are then imported back into the database, and merged with the full employer record. In brief, the algorithm used by this program is as follows:

For each TAZ, extract the Employer Database and Land Use Database records

> Calculate employment by land use from Employer Database based on Primary Alternative
> Calculate employment potential by land use based on acres and density assumptions
>
> For each land use, compare Employer Database with Land Use potential employment
> If enough land exists, then assignment to primary land use is O.K.
> Else If there is potential in a designated alternative, then re-assign
> Else Check other employment land uses
> Else Check for residential assignment
> Else (not residential compatible and no employment potential exists) Retain Primary Alternative assignment (could be an error)

TABLE 12

Alternative Land Use Assignments by Industry Group

Beginning SIC	Ending SIC	Industry Group Name	Primary	Secondary	Tertiary
0111	0724	Crops	5	2	6
0741	0741	Veterinary Services for Livestock	5	2	6
0742	0742	Veterinary services, specialties	1	2	6
0751	0762	Farm/Animal Other	5	2	6
0781	0781	Landscape counseling and planning	1	2	6
0782	0783	Lawn and garden services	3	2	6
0811	0811	Timber tracts	5	2	6
0831	0851	Forest products & services	3	5	6
0912	0971	Fishing & Hunting	5	4	6
1011	1241	Mining	3	5	4
1311	1389	Oil & Gas Extraction	5	4	3
1411	1499	Miscellaneous nonmetallic minerals	3	5	4
1521	1522	Residential construction	3	2	6
1531	1542	Nonresidential construction	3	2	5
1611	1629	Highway and street construction	3	2	5
1711	1799	Special trade contractors	3	2	5
2011	2099	Food Processing	3	2	5
2111	2141	Tobacco products	3	2	5
2211	2299	Textile goods	3	2	5
2311	2399	Fabricated textile products	3	2	5
2411	2411	Logging	5	4	6
2421	2439	Structural wood members	3	5	2
2441	2499	Wood products	3	5	2
2511	2599	Furniture and fixtures	3	2	5
2611	2631	Pulp & paper mills	3	2	5
2652	2679	Converted paper products	3	2	5
2711	2711	Newspapers	3	2	5
2721	2796	Periodicals, books, commercial printi	3	2	5
2812	2899	Chemical preparations	3	2	5
2911	2911	Petroleum refining	3	5	5
2951	2999	Petroleum and coal products	3	2	5
3011	3069	Fabricated rubber products	3	2	5
3081	3089	Plastics products	3	2	5
3111	3149	Footwear, except rubber	3	2	5
3151	3199	Leather goods	3	1	6
3211	3231	Glass products	3	1	5
3241	3259	Structural clay products	3	2	5
3261	3269	Pottery products	3	1	5
3271	3299	Nonmetallic mineral products	3	5	2
3312	3325	Steel foundries	3	5	2
3331	3399	Primary metal products	3	2	5
3411	3499	Fabricated metal products	3	2	5
3511	3569	Industrial machinery	3	2	5
3571	3579	Computers & office machines	3	2	5
3581	3599	Service industry machinery	3	2	5
3612	3629	Electrical industrial apparatus	3	2	5
3631	3639	Household appliances	3	2	5

Land Use Codes: 1 - Retail 2 - Office 3 - Industrial 4 - Public 5 - Other 6 - Residential

TABLE 12

Alternative Land Use Assignments by Industry Group

Beginning SIC	Ending SIC	Industry Group Name	Primary	Secondary	Tertiary
3641	3648	Lighting equipment	3	2	5
3651	3669	Communications equipment	3	2	5
3671	3679	Electronic components	3	2	5
3691	3699	Electrical equipment and supplies, N	3	2	5
3711	3799	Transportation equipment	3	2	5
3812	3812	Search and navigation equipment	3	2	5
3821	3829	Measuring & controlling devices	3	2	5
3841	3851	Surgical and medical instruments	3	2	5
3861	3861	Photographic equipment and supplies	3	2	5
3873	3999	Other manufactured goods (consumer	3	2	5
4011	4013	Railroads, line-haul operating	3	5	4
4111	4119	Local and suburban transit	4	5	3
4121	4142	Taxicabs & buses for hire	3	4	2
4151	4151	School buses	4	5	2
4173	4173	Bus terminal and service facilities	3	1	2
4212	4214	Trucking	3	5	2
4215	4215	Courier services, except by air	2	1	3
4221	4231	Warehousing	3	5	2
4311	4311	U.S. Postal Service	4	5	2
4412	4449	Water transportation of freight	3	5	2
4481	4489	Water transportation of passengers	4	5	2
4491	4491	Water transportation services	4	5	2
4512	4512	Air transportation, scheduled	4	2	5
4513	4581	Air courier services, airports	4	5	2
4612	4619	Pipe lines	5	2	4
4724	4724	Travel agencies	1	2	5
4725	4725	Tour operators	1	5	2
4729	4729	Passenger transport arrangement, NE	1	2	5
4731	4789	Freight transportation services	3	2	5
4812	4899	Communication services	3	2	4
4911	4999	Utilities	3	2	4
5012	5099	Wholesale trade - durable goods	3	1	2
5111	5199	Wholesale trade - nondurable goods	3	1	2
5211	5999	Retail trade	1	3	2
6011	6019	Central reserve depository	2	4	5
6021	6029	Commercial banks	2	1	5
6035	6035	Federal savings institutions	2	4	5
6036	6062	Savings institutions, except federal	2	1	5
6081	6082	Branches and agencies of foreign ban	2	4	5
6091	6099	Nondeposit trust facilities	2	1	5
6111	6289	Security and commodity services	2	1	5
6311	6399	Insurance carriers	2	1	5
6411	6411	Insurance agents, brokers, & service	1	2	6
6512	6519	Real property lessors	2	1	6
6531	6553	Real estate agents, managers, develop	2	1	5
6712	6799	Financial Services	2	1	5
7011	7011	Hotels and motels	5	1	2

Land Use Codes: 1 - Retail 2 - Office 3 - Industrial 4 - Public 5 - Other 6 - Residential

TABLE 12

Alternative Land Use Assignments by Industry Group

Beginning SIC	Ending SIC	Industry Group Name	Primary	Secondary	Tertiary
7021	7021	Rooming and boarding houses	6	5	2
7032	7032	Sporting and recreational camps	5	4	2
7033	7033	Trailer parks and campsites	5	4	2
7041	7041	Membership-basis organization hotels	5	4	2
7211	7211	Power laundries, family & commercia	1	3	5
7212	7212	Garment pressing & cleaners' agents	1	3	5
7213	7213	Linen supply	3	1	5
7215	7215	Coin-operated laundries and cleaning	1	3	5
7216	7219	Laundry and garment services	1	3	5
7221	7299	Personal Services	1	2	3
7311	7349	Business services	2	3	1
7352	7352	Medical equipment rental	2	3	1
7353	7353	Heavy construction equipment rental	3	2	5
7359	7359	Equipment rental & leasing, NEC	1	3	2
7361	7363	Employment agencies	1	2	3
7371	7373	Computer programming services	2	3	6
7374	7375	Data processing and preparation	2	3	6
7376	7379	Computer related services	2	1	6
7381	7382	Detective, guard, & armored car svcs	2	1	6
7383	7383	News syndicates	2	3	5
7384	7384	Photofinishing laboratories	3	1	2
7389	7389	Business services, NEC	2	1	3
7513	7519	Truck/trailer rental and leasing	3	2	5
7521	7521	Automobile parking	5	4	3
7532	7539	Automotive repair shops	3	1	5
7542	7549	Car washes, auto services	1	3	5
7622	7699	Other repair shops	1	3	6
7812	7819	Motion picture & video production	2	3	5
7822	7829	Motion picture and tape distribution	2	3	5
7832	7833	Motion picture theaters	1	5	2
7841	7841	Video tape rental	1	2	5
7911	7911	Dance halls, studios, and schools	1	2	3
7922	7929	Theatrical producers and services	2	1	3
7933	7933	Bowling alleys	1	5	3
7941	7941	Sports clubs, managers, & promoters	2	1	5
7948	7948	Racing, including track operation	5	2	4
7991	7991	Physical fitness facilities	1	2	5
7992	7992	Public golf courses	5	1	2
7993	7993	Coin-operated amusement devices	3	1	2
7996	7996	Amusement parks	5	1	2
7997	7997	Membership sports & recreation club	1	5	2
7999	7999	Amusement and recreation, NEC	1	5	2
8011	8049	Medical office	2	1	5
8051	8059	Care facilities	2	5	6
8062	8069	Hospitals, general medical & surgical	5	2	1
8071	8072	Medical & dental laboratories	2	3	1
8082	8082	Home health care services	2	1	5

Land Use Codes: 1 - Retail 2 - Office 3 - Industrial 4 - Public 5 - Other 6 - Residential

TABLE 12

Alternative Land Use Assignments by Industry Group

Beginning SIC	Ending SIC	Industry Group Name	Primary	Secondary	Tertiary
8092	8092	Kidney dialysis centers	5	2	1
8093	8099	Specialty outpatient facilities, NEC	5	2	1
8111	8111	Legal services	2	1	5
8211	8211	Elementary and secondary schools	4	5	2
8221	8222	Colleges and universities, NEC	4	5	2
8231	8231	Libraries	4	1	5
8243	8299	Schools & educational services, NEC	2	1	4
8322	8399	Social services	2	1	6
8412	8412	Museums and art galleries	4	2	1
8422	8422	Botanical and zoological gardens	4	5	2
8611	8651	Membership organizations	2	1	3
8661	8661	Religious organizations	5	1	2
8699	8699	Membership organizations, NEC	2	1	5
8711	8721	A&E, Survey, Accounting services	2	1	5
8731	8731	Commercial physical research	3	5	2
8732	8732	Commercial nonphysical research	3	2	5
8733	8733	Noncommercial research organization	2	1	5
8734	8734	Testing laboratories	2	3	5
8741	8743	Management consulting services	2	3	6
8744	8744	Facilities support management servic	2	3	5
8748	8748	Business consulting services, NEC	2	3	6
8811	8811	Private households	6	2	1
8999	8999	Services, NEC	2	1	3
9111	9451	General government	4	2	3
9511	9511	Air and water and solid waste mgmt	4	5	2
9512	9512	Land, mineral, wildlife conservation	4	2	5
9531	9611	Housing, community & economic pro	4	2	1
9621	9651	Regulation, admin of transportation	4	2	5
9661	9661	Space research and technology	4	3	5
9711	9711	National Security	4	5	2
9721	9721	International affairs	4	2	5
9999	9999	Nonclassifiable establishments	5	3	2

The results from the re-assignment model for establishments and employment are shown in Table 13. In general, the great majority of employers maintained their initial (primary) land use designations, as expected. However, a significant number of re-assignments were also made.

The most dramatic rate of re-assignment occurred in the industrial use category, where about half of all employers were re-assigned to other land use categories. This was not totally unexpected since many employers in the manufacturing sector of the economy in Maricopa County operate in office-like buildings. Also, while about half the industrial employers where re-assigned, these re-assignments accounted for only about 28 percent of employment originally assigned to an industrial land use.

Similarly, a fair number (about 10 percent) of employers where assigned to the residential land use category, although they accounted for only about 1.3 percent of total employment. This number of re-assignments to residential was made despite fairly stringent standards. To be assigned to the residential category an employer must have no land use potential in any of its three designated alternatives (based on the industry to land use table) or any other employment land use, have less than 4 employees, and not be engaged in manufacturing activities.

The final distribution of employment by land use seems reasonable. The retail, office and industrial land use categories each contain about 25 percent of employment, with the balance being distributed fairly evenly between the public and other employment land use categories. The 1.3 percent assignment to residential also seems reasonable in this context.

5.3 FINAL EMPLOYMENT ESTIMATES

As a result of the benchmarking and land use assignment tasks, the employment estimates by TAZ were developed by simply tabulating data from the employer database. The tabulation was performed by summing employment in a cross-tabulation of TAZ and land use category. Due to rounding, total employment is slightly less than the County control total, but only very slightly.

Table 14 shows the resulting employment estimates by Municipal Planning Area (MPA), while Table 15 reports both MPA and Regional Analysis Zone (RAZ) information.

TABLE 13
RESULTS OF LAND USE ASSIGNMENT MODEL
ESTABLISHMENTS AND EMPLOYMENT BY LAND USE

Initial Land Use	Final Land Use Assignment						
	Retail	Office	Industrial	Public	Other	Residential	Total
Employer Sites							
Retail	24,750	35	12	62	465	879	26,203
Office	252	22,518	100	1,273	1,433	3,884	29,460
Industrial	643	1,729	12,404	2,677	2,955	3,941	24,349
Public	13	7	13	1,390	84	35	1,542
Other	66	73	11	288	2,424	304	3,166
Residential						12	12
Total	25,724	24,362	12,540	5,690	7,361	9,055	84,732
Employment							
Retail	297,548	441	87	739	12,617	1,498	312,930
Office	1,990	279,092	845	10,525	16,853	7,105	316,410
Industrial	4,997	32,716	292,473	23,846	42,141	7,377	403,550
Public	327	411	665	130,625	9,114	61	141,203
Other	809	1,262	93	5,259	82,646	582	90,651
Residential	0	0	0	0	0	56	56
Total	305,671	313,922	294,163	170,994	163,371	16,679	1,264,800
Employment Percent							
Retail	23.5%	0.0%	0.0%	0.1%	1.0%	0.1%	24.7%
Office	0.2%	22.1%	0.1%	0.8%	1.3%	0.6%	25.0%
Industrial	0.4%	2.6%	23.1%	1.9%	3.3%	0.6%	31.9%
Public	0.0%	0.0%	0.1%	10.3%	0.7%	0.0%	11.2%
Other	0.1%	0.1%	0.0%	0.4%	6.5%	0.0%	7.2%
Residential	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	24.2%	24.8%	23.3%	13.5%	12.9%	1.3%	100.0%

Source: Applied Economics, 1996.

TABLE 14

JULY 1995 Employment Estimates by Land Use by MPA

18-Nov-97

MPA	Total	Retail	Office	Industrial	Public	Other	Residential
Avondale	3,601	602	126	228	1,081	1,487	77
Buckeye	3,595	685	18	815	479	1,547	51
Carefree	1,719	497	0	0	0	1,114	108
Cave Creek	1,471	1,417	0	0	0	0	54
Chandler	47,288	9,722	5,508	19,767	5,766	6,000	525
County	25,968	8,776	4,404	4,313	2,301	5,968	206
El Mirage	971	276	0	25	457	205	8
Fountain Hills	3,642	1,588	118	0	1,630	0	306
Gila Bend	781	191	0	0	0	575	15
Gila River	3,393	0	18	3,016	2	355	2
Gilbert	16,339	2,972	1,533	6,651	2,722	2,167	294
Glendale	62,805	17,019	3,596	13,516	15,760	11,964	950
Goodyear	5,396	1,066	8	2,127	932	1,225	38
Guadalupe	464	149	0	59	120	136	0
Litchfield Park	1,462	158	49	52	191	976	36
Mesa	128,376	41,350	33,373	18,738	17,741	15,356	1,818
Paradise Valley	5,922	165	935	238	875	3,464	245
Peoria	14,868	4,561	1,686	3,206	2,242	2,912	261
Phoenix	664,280	148,039	185,779	160,250	86,039	76,044	8,129
Queen Creek	1,441	87	0	259	49	1,026	20
Scottsdale	118,609	34,720	44,338	11,335	8,154	17,725	2,337
Surprise	2,662	866	333	27	102	1,290	44
Tempe	138,857	28,671	30,961	48,032	23,533	6,668	992
Tolleson	6,199	343	712	1,333	324	3,444	43
Wickenburg	3,362	1,122	427	176	207	1,359	71
Youngtown	1,329	629	0	0	287	364	49
Maricopa County Total:	**1,264,800**	**305,671**	**313,922**	**294,163**	**170,994**	**163,371**	**16,679**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
Avondale								
	RAZ 273	2,262	397	96	0	750	974	45
	RAZ 282	1,339	205	30	228	331	513	32
	RAZ 303	0	0	0	0	0	0	0
	Total Avondale	**3,601**	**602**	**126**	**228**	**1,081**	**1,487**	**77**
Buckeye								
	RAZ 277	262	18	0	0	0	239	5
	RAZ 278	2,422	636	0	815	246	697	28
	RAZ 279	911	31	18	0	233	611	18
	RAZ 340	0	0	0	0	0	0	0
	RAZ 341	0	0	0	0	0	0	0
	Total Buckeye	**3,595**	**685**	**18**	**815**	**479**	**1,547**	**51**
Carefree								
	RAZ 208	1,719	497	0	0	0	1,114	108
	Total Carefree	**1,719**	**497**	**0**	**0**	**0**	**1,114**	**108**
Cave Creek								
	RAZ 207	1,471	1,417	0	0	0	0	54
	Total Cave Creek	**1,471**	**1,417**	**0**	**0**	**0**	**0**	**54**
Chandler								
	RAZ 310	14,044	6,306	2,620	1,611	2,775	516	216
	RAZ 315	14,588	1,192	967	9,311	422	2,614	82
	RAZ 316	8,390	1,444	1,528	3,101	1,046	1,180	91
	RAZ 317	3,549	623	378	921	1,368	212	47
	RAZ 325	5,019	67	15	3,936	142	804	55
	RAZ 327	770	77	0	202	13	463	15
	RAZ 328	928	13	0	685	0	211	19
	Total Chandler	**47,288**	**9,722**	**5,508**	**19,767**	**5,766**	**6,000**	**525**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
County								
	RAZ 202	0	0	0	0	0	0	0
	RAZ 203	198	38	0	0	37	96	27
	RAZ 204	282	0	121	0	84	74	3
	RAZ 205	384	12	0	0	368	4	0
	RAZ 213	0	0	0	0	0	0	0
	RAZ 220	19	2	0	8	0	4	5
	RAZ 221	2,773	1,020	1,013	0	69	647	24
	RAZ 231	226	128	0	0	95	0	3
	RAZ 237	9,804	3,556	3,154	0	676	2,329	89
	RAZ 251	1,726	1,726	0	0	0	0	0
	RAZ 252	0	0	0	0	0	0	0
	RAZ 253	105	3	8	33	0	61	0
	RAZ 264	3,255	1,528	100	489	671	454	13
	RAZ 301	55	4	0	0	0	51	0
	RAZ 326	2,123	467	8	4	146	1,478	20
	RAZ 329	497	5	0	0	54	424	14
	RAZ 330	30	0	0	0	0	30	0
	RAZ 332	7	0	0	0	7	0	0
	RAZ 333	4,233	266	0	3,767	25	174	1
	RAZ 334	122	21	0	12	69	18	2
	RAZ 335	8	0	0	0	0	8	0
	RAZ 336	62	0	0	0	0	58	4
	RAZ 337	59	0	0	0	0	58	1
	Total County	**25,968**	**8,776**	**4,404**	**4,313**	**2,301**	**5,968**	**206**
El Mirage								
	RAZ 235	971	276	0	25	457	205	8
	Total El Mirage	**971**	**276**	**0**	**25**	**457**	**205**	**8**
Fountain Hills								
	RAZ 250	3,642	1,588	118	0	1,630	0	306
	Total Fountain Hills	**3,642**	**1,588**	**118**	**0**	**1,630**	**0**	**306**
Gila Bend								
	RAZ 331	781	191	0	0	0	575	15
	Total Gila Bend	**781**	**191**	**0**	**0**	**0**	**575**	**15**
Gila River								
	RAZ 324	3,393	0	18	3,016	2	355	2
	Total Gila River	**3,393**	**0**	**18**	**3,016**	**2**	**355**	**2**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
Gilbert								
	RAZ 311	14,273	2,787	1,522	6,556	2,135	1,046	227
	RAZ 312	701	10	0	0	389	285	17
	RAZ 318	1,007	159	0	0	168	638	42
	RAZ 319	358	16	11	95	30	198	8
	Total Gilbert	**16,339**	**2,972**	**1,533**	**6,651**	**2,722**	**2,167**	**294**
Glendale								
	RAZ 222	8,677	3,542	192	2,100	943	1,731	169
	RAZ 240	11,041	3,022	1,747	57	1,712	4,331	172
	RAZ 254	137	0	0	0	0	106	31
	RAZ 255	651	153	8	75	10	390	15
	RAZ 256	7,199	17	21	0	7,155	0	6
	RAZ 257	4,702	747	60	1,896	534	1,406	59
	RAZ 258	30,398	9,538	1,568	9,388	5,406	4,000	498
	Total Glendale	**62,805**	**17,019**	**3,596**	**13,516**	**15,760**	**11,964**	**950**
Goodyear								
	RAZ 265	4	0	0	0	0	4	0
	RAZ 280	3,392	1,061	0	745	892	659	35
	RAZ 281	1,804	5	8	1,378	0	410	3
	RAZ 302	98	0	0	4	40	54	0
	RAZ 323	98	0	0	0	0	98	0
	Total Goodyear	**5,396**	**1,066**	**8**	**2,127**	**932**	**1,225**	**38**
Guadalupe								
	RAZ 307	464	149	0	59	120	136	0
	Total Guadalupe	**464**	**149**	**0**	**59**	**120**	**136**	**0**
Litchfield Park								
	RAZ 266	1,462	158	49	52	191	976	36
	Total Litchfield Park	**1,462**	**158**	**49**	**52**	**191**	**976**	**36**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
Mesa								
	RAZ 289	27,880	9,591	7,177	7,048	1,497	2,324	243
	RAZ 290	27,820	7,257	9,655	620	7,466	2,363	459
	RAZ 291	6,977	1,580	1,217	494	1,549	1,917	220
	RAZ 292	7,279	315	310	6,157	349	95	53
	RAZ 293	3,456	995	511	304	1,216	321	109
	RAZ 294	162	8	44	37	25	14	34
	RAZ 295	811	470	69	24	157	46	45
	RAZ 298	7,111	3,352	1,104	0	1,188	1,205	262
	RAZ 299	12,105	6,638	2,894	309	945	1,203	116
	RAZ 300	1,007	528	97	47	187	99	49
	RAZ 309	29,130	10,276	8,497	2,036	3,063	5,036	222
	RAZ 320	173	0	0	49	0	123	1
	RAZ 321	959	340	0	23	99	492	5
	RAZ 322	3,506	0	1,798	1,590	0	118	0
	Total Mesa	**128,376**	**41,350**	**33,373**	**18,738**	**17,741**	**15,356**	**1,818**
Paradise Valley								
	RAZ 262	5,922	165	935	238	875	3,464	245
	Total Paradise Valley	**5,922**	**165**	**935**	**238**	**875**	**3,464**	**245**
Peoria								
	RAZ 214	84	22	8	43	0	0	11
	RAZ 215	1,294	576	0	0	187	483	48
	RAZ 238	7,576	2,784	1,678	585	943	1,449	137
	RAZ 239	5,914	1,179	0	2,578	1,112	980	65
	Total Peoria	**14,868**	**4,561**	**1,686**	**3,206**	**2,242**	**2,912**	**261**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
Phoenix								
	RAZ 206	392	42	0	0	64	255	31
	RAZ 216	4	4	0	0	0	0	0
	RAZ 217	854	25	4	277	545	0	3
	RAZ 218	349	18	8	69	99	106	49
	RAZ 219	116	20	0	4	36	56	0
	RAZ 223	3,031	94	899	804	1,005	156	73
	RAZ 224	12,926	3,939	3,484	2,500	1,967	807	229
	RAZ 225	14,992	607	8,665	4,029	786	801	104
	RAZ 226	16,523	4,630	6,565	1,937	2,212	972	207
	RAZ 227	3,777	1,161	198	4	1,910	391	113
	RAZ 228	333	58	0	0	112	149	14
	RAZ 241	9,890	4,337	1,237	1,506	1,905	704	201
	RAZ 242	7,468	3,989	1,292	353	1,205	462	167
	RAZ 243	43,463	16,632	12,339	9,180	3,074	1,879	359
	RAZ 244	17,907	4,793	5,414	2,286	1,724	3,173	517
	RAZ 245	13,764	5,458	3,110	542	3,561	636	457
	RAZ 246	18,640	8,772	5,259	1,266	2,276	464	603
	RAZ 259	17,588	6,548	4,111	2,940	2,619	1,067	303
	RAZ 260	25,349	8,653	10,765	1,647	2,028	1,605	651
	RAZ 261	29,741	8,631	14,529	2,363	1,037	2,649	532
	RAZ 267	5,340	3,203	7	0	937	1,094	99
	RAZ 268	12,111	3,972	811	1,608	4,458	1,082	180
	RAZ 269	35,240	5,391	4,351	22,260	1,929	1,074	235
	RAZ 270	78,044	15,181	37,004	6,963	9,864	8,084	948
	RAZ 271	51,239	18,259	21,105	3,335	3,394	4,357	789
	RAZ 275	63,895	4,169	25,463	11,393	19,032	3,626	212
	RAZ 276	20,409	4,113	4,720	2,505	2,243	6,648	180
	RAZ 283	699	4	42	157	304	187	5
	RAZ 284	21,487	47	353	18,342	59	2,676	10
	RAZ 285	14,526	1,101	304	9,486	3,279	326	30
	RAZ 286	15,170	1,120	1,051	10,191	1,174	1,588	46
	RAZ 287	53,384	3,805	5,310	18,840	4,333	20,922	174
	RAZ 296	32,611	2,998	2,975	21,315	3,942	1,235	146
	RAZ 304	716	43	4	212	170	249	38
	RAZ 305	1,985	246	45	0	449	1,203	42
	RAZ 306	10,751	2,134	2,105	734	1,115	4,526	137
	RAZ 313	2,273	847	233	109	729	217	138
	RAZ 314	7,293	2,995	2,017	1,093	463	618	107
	Total Phoenix	**664,280**	**148,039**	**185,779**	**160,250**	**86,039**	**76,044**	**8,129**

TABLE 15

JULY 1995 Employment Estimates by Land Use by MPA/RAZ

18-Nov-97

MPA	RAZ	Total	Retail	Office	Industrial	Public	Other	Residential
Queen Creek								
	RAZ 339	1,441	87	0	259	49	1,026	20
	Total Queen Creek	**1,441**	**87**	**0**	**259**	**49**	**1,026**	**20**
Scottsdale								
	RAZ 209	1,257	621	335	16	153	46	86
	RAZ 210	462	186	262	8	0	0	6
	RAZ 229	2,758	1,582	888	53	117	28	90
	RAZ 230	2,294	21	142	21	13	2,077	20
	RAZ 247	22,849	6,107	9,645	156	2,071	4,516	354
	RAZ 248	13,983	2,818	6,768	373	1,324	2,483	217
	RAZ 249	3,190	472	1,866	64	194	482	112
	RAZ 263	21,795	4,537	9,588	1,366	1,180	4,736	388
	RAZ 272	50,021	18,376	14,844	9,278	3,102	3,357	1,064
	Total Scottsdale	**118,609**	**34,720**	**44,338**	**11,335**	**8,154**	**17,725**	**2,337**
Surprise								
	RAZ 211	0	0	0	0	0	0	0
	RAZ 212	181	10	7	0	0	155	9
	RAZ 232	511	0	0	0	0	493	18
	RAZ 233	301	2	73	0	0	212	14
	RAZ 234	1,669	854	253	27	102	430	3
	Total Surprise	**2,662**	**866**	**333**	**27**	**102**	**1,290**	**44**
Tempe								
	RAZ 288	66,684	11,295	9,257	23,760	18,455	3,452	465
	RAZ 297	44,905	9,883	17,277	12,109	2,955	2,381	300
	RAZ 308	27,268	7,493	4,427	12,163	2,123	835	227
	Total Tempe	**138,857**	**28,671**	**30,961**	**48,032**	**23,533**	**6,668**	**992**
Tolleson								
	RAZ 274	6,199	343	712	1,333	324	3,444	43
	Total Tolleson	**6,199**	**343**	**712**	**1,333**	**324**	**3,444**	**43**
Wickenburg								
	RAZ 201	3,362	1,122	427	176	207	1,359	71
	Total Wickenburg	**3,362**	**1,122**	**427**	**176**	**207**	**1,359**	**71**
Youngtown								
	RAZ 236	1,329	629	0	0	287	364	49
	Total Youngtown	**1,329**	**629**	**0**	**0**	**287**	**364**	**49**
Maricopa County Total:		**1,264,800**	**305,671**	**313,922**	**294,163**	**170,994**	**163,371**	**16,679**